ATOMIC ENERGY CONTROL BOARD

Administrative Law Series

This study was prepared by the author at the request of the Commission. Research began in mid-1975 and ended in December 1975. It should, therefore, be borne in mind that changes may have occurred since that time. The study represents the views of the author. It will, however, play a role in shaping the Commission's views and eventual proposals for reform of administrative law and procedures. Accordingly the Commission welcomes comments on the study.

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THE ATOMIC ENERGY CONTROL BOARD

An Evaluation of Regulatory and Administrative Processes and Procedures

Prepared for the

Law Reform Commission of Canada

by

G. Bruce Doern

Acknowledgments

I wish to express my appreciation to the many people in the Atomic Energy Control Board, the Law Reform Commission, other federal and provincial departments and agencies, as well as representatives of unions and other nuclear interests whose cooperation made this study possible.

Special thanks are owed to Sandra McCallum, Roger Turcotte and John Grenier for their research assistance.

G. Bruce Doern

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Foreword

Unlike its companions in the Law Reform Commission's series of studies of federal administrative agencies, this study of the Atomic Energy Control Board was undertaken by a social scientist. Professor Bruce Doern's particular area of interest is public administration. Consequently, the emphasis in this study is more on the agency's organizational and administrative aspects than on its legal context. Once again, however, the study's overall concern is with the broader problems associated with the agency's practices and procedures.

The research for this study, fortunately, coincided with efforts in the Atomic Energy Control Board and in other parts of government to reassess the Board's mandate and methods. We hope the study will prove useful to those designing the future role of this increasingly important regulatory agency.

Law Reform Commission of Canada
October 1976

Introduction

This study* describes and assesses the regulatory and administrative processes and procedures of the Atomic Energy Control Board, the AECB. *The Atomic Energy Control Act* authorized the AECB to control atomic energy materials and equipment in the national interest and to participate in measures for the international control of atomic energy. The AECB is authorized to make regulations to control atomic energy materials and equipment and to make grants in support of atomic energy research.

Although the AECB has been in existence for almost thirty years, only in this decade has it received a visibility and public exposure commensurate with its importance. This increased visibility is a direct function of the growing importance of nuclear energy as an alternative or complementary source of energy to oil, gas, coal and hydroelectric power, as well as public concern about the environmental and health consequences of the nuclear alternative. The evolution and functioning of the AECB is also conditioned by CANDU, a Canadian designed and built nuclear reactor.[1] There are high economic and political stakes in CANDU's future. In economic terms, its technology has an important export potential developed largely by a federal state enterprise, Atomic Energy of Canada Limited (AECL). In political terms, CANDU must cope with increasingly complicated relationships between federal and provincial crown corporations as well as major foreign policy issues concerning Canada's commitments to the non-proliferation of nuclear weapons and peaceful development of nuclear energy.

It must be stressed at the outset that the AECB's roles, structures and processes are especially affected by the mandate of the AECB which far more than other federal regulatory boards is characterized by technological complexity and scientific mystery. The AECB deals with a realm of activity not easily comprehended by the general public. Consequently, it is all the more important that the AECB's processes, procedures and related policies be scrutinized.

Another complicating feature of the nuclear regulatory process in Canada is the nuclear industry's domination by state-owned enterprises.

EDITOR'S NOTE: Notes, in this paper, are to be found on pages 47 to 49.

While a significant and growing privately-owned nuclear components industry exists, federal enterprises such as AECL and Eldorado Nuclear Limited and provincial utilities such as Ontario Hydro, Hydro Quebec, and the New Brunswick Electric Power Commission, are the real players. Regulatory authorities cannot avoid complex and conflicting political cross-pressures that arise in relationships between a federal nuclear entrepreneur (AECL) and provincial utilities. The problems of regulating in such an environment cannot be underestimated.

This report deals primarily with processes and procedures rather than with substantive policies. It is impossible, and perhaps undesirable, to separate policy totally from process. And so the policy background and mandate of the AECB will be described and analyzed to the extent that it affects processes and procedures.

Our* analysis of AECB processes and procedures has included the following:

1. General decision-making by the agency, its senior staff and advisory committees;

2. Regulation-making;

3. Licensing and related procedures;

4. Allocation of grants;

5. Compliance; and

6. Public information.

The normative standards against which these processes can be evaluated are not easily stated. In general, AECB's processes will be assessed against general tenets of openness and procedural fairness. Its regulation-making functions will be examined in terms of their effectiveness for consultation or participation of affected publics.[2] These processes include not only formal public hearings but also informal proceedings such as meetings, conferences and other information dissemination practices. The review of the agency's licensing processes includes a consideration of the need for hearings, rights of appeal and the adequacy of evaluation by AECB's staff of each licence application. Compliance processes will be similarly assessed against general standards of administrative reasonableness that encompasses both actual and apparent enforcement. It will be argued that both the *substance* and the *appearance* of compliance processes take on added importance in regulatory activity the more a regulatory authority is involved in an area characterized by technological complexity. The public information components of each of the regulation-making, licensing and compliance processes will also be examined.

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*''Our'' refers to the author and his research associates. — Ed.

The report's consideration of AECB procedures permits some general observations. While the AECB has demonstrated a frank awareness of most of its procedural inadequacies and has taken several steps in recent years towards improvement, neither the agency nor the federal government have gone far enough in reforming the agency's regulatory and administrative processes.

The inherent importance of this particular regulatory domain and its unique degree of technological complexity are factors supporting a continuing assessment and improvement of AECB processes and procedures.

The adequacy of past AECB performance and the assignment of responsibility for current and future reform can only be assessed by a research approach which treats the AECB as a living, breathing organization, operating under certain constraints in a political and social environment that clearly has changed over the past thirty years. Consequently, the approach taken in this study is patterned on case studies of organizational behaviour.[3]

Research has included examination of public documents as well as unpublished and internal reports. In addition, confidential interviews were conducted with AECB members and staff, officials of federal and provincial departments and agencies, industrial spokesmen and other concerned individuals in some instances associated with public interest groups. These interviews helped to sketch an aggregate portrait of how the roles, structures and processes of the AECB are perceived and evaluated by those closely involved or affected by the agency's work.

To augment and complement the above sources of information and opinion, three case studies were carried out, each dealing with different aspects of the AECB's activities. These are briefly described and analyzed in the appendix attached to this study. First is the *Lepreau Case*, a study of the *licensing* process for a major nuclear power plant, second, the *Uranium Mining Safety Case*, a study of *regulation-making and compliance* processes, and third, the *Nuclear Powered Pace Maker Case*, a study involving both regulation-making and licensing for a novel nuclear technology that is difficult to monitor or control.

The study is organized so that the reader proceeds from description to analysis. Chapter I describes the statutory and policy mandate of the AECB and identifies the major issues of nuclear regulation.

Chapter II examines the formal organization of the AECB and the central "rhythms" of regulation in which it operates. This chapter also

describes the main constituencies of the nuclear industry the agency has been authorized to regulate and control.

Chapter III analyzes the more dynamic and informal aspects of AECB behaviour, the views of its chairmen and members, the career patterns of board members and staff, the budgetary constraints under which it operates, the influence of scientific and professional norms, the relationship of the AECB to Cabinet ministers, politicians and the media, and the models of the public interest under which it implicitly or explicitly operates.

Chapter IV of the study offers concluding observations and suggestions regarding nuclear regulatory processes. The three case studies attached as appendices provide insights that helped to shape this chapter as well as earlier portions of the study.

CHAPTER I

The Statutory and Policy Mandate of the AECB

A) The *Atomic Energy Control Act*

The primary roles of the Atomic Energy Control Board are set out in the *Atomic Energy Control Act*, first enacted in 1946, but are also influenced by non-statutory policy statements on such matters as uranium and safeguards as well as by related federal and provincial statutes and regulations.[4]

The *Atomic Energy Control Act* authorizes the AECB to regulate and control atomic energy materials and equipment in the interests of safety and physical welfare, to control atomic energy materials, equipment and information in the interests of national and international security and to promote atomic energy research.[5]

Passed just after World War II, the Act reflects a paramount concern for security where strategic materials are involved. Accordingly, the Act confers on the AECB and the Cabinet a great array of powers. These include the powers to regulate, to license, to revoke or suspend licences, to expropriate, to create Crown enterprises, to require the submission of information and reports and to give grants for research and development. The Act's concern for security, however, left little room for statutory provisions protecting the people who fall within its regulatory ambit. It does not provide for hearings at any stage of its regulatory activities. Given the Act's conception in the security conscious environment of the post-war period, the scope and breadth of the powers it conferred are understandable, though nonetheless extraordinary when compared with the arsenals of other federal regulatory agencies.

While its constitutional authority seems clear,[6] the AECB has treaded carefully. This is particularly apparent in matters concerning health that fall beyond the immediate perimeters of a nuclear facility or uranium mine. Here, AECB powers impinge on provincial jurisdiction over health and resources. The three case studies elaborate on these jurisdictional overlaps. In general terms, however, the *Atomic Energy Control Act* has soundly armed the AECB and the Cabinet with a wide array of constitutionally secure regulatory powers.

B) The Atomic Energy Control Regulations

Many of the AECB's powers are exercised through the agency's Atomic Energy Control Regulations.[7] These establish a comprehensive licensing system. Strategic or security controls are available for a number of prescribed substances, strategic materials (such as uranium, plutonium, thorium and heavy water) and equipment through a permit system operated with the cooperation of the Departments of Industry, Trade and Commerce for exports and National Revenue for imports. International controls are achieved and international commitments met by cooperation with inspectors of the International Atomic Energy Agency. These officials carry out inspections of safeguards under international agreements to which Canada is a party.

Control over prescribed substances for safety purposes is secured by the provision in the regulations that no person shall

> produce, mine, prospect for, refine, use, sell or possess for any purpose prescribed substances except in accordance with a licence issued by the AECB.[8]

The licensing process requires the prospective user to provide information on the prescribed substance, its proposed application, operational, safety and physical security procedures and equipment, qualifications and experience of users, radioactive waste management plans and environmental considerations. If a licence is issued, the licensee's compliance with AECB requirements is monitored by the agency's inspection officers. Approximately 5,000 licences are now in force. Some 2,000 licences (primarily for radioisotopes) and amendments were processed in 1974-75.

The prospective user or owner of designated nuclear facilities and equipment (nuclear reactors for research or power production, particle accelerators, mines, heavy water plants, large-scale industrial and medical irradiators, uranium processing and fabrication plants, and radio-active waste management facilities) must obtain an AECB licence for construction

and for operation. Information is required on siting, design, construction, commissioning and testing, operation, operator qualifications, safety and physical security equipment and procedures, radioactive waste management and environmental effects. Again, the issue of a licence activates AECB inspection. Major facilities now licensed include nuclear power reactors in the Ontario Hydro, Hydro Quebec, and New Brunswick Electric Power Commission systems as well as research reactors at McMaster University and the University of Toronto.

The *Lepreau Case* described in the Appendix to this study illustrates the formal and informal licensing process for major facilities. Briefly, there are two formal licensing stages, construction approval and approval to commence operation. Preceding these stages is the site approval stage. Although not regarded by the AECB as part of its licensing process, the agency's inevitable involvement in site selection is impossible to sever from the steps that culminate in agency decisions on construction and operation.

After receipt of an official letter of intent from an applicant, the AECB normal procedure is to establish a Reactor Safety Advisory Committee (RSAC). Members of an RSAC include experts, representatives of relevant federal and provincial departments and local health officials. No reactor has been licensed by the AECB without a favourable review by such a committee. The RSAC assesses the adequacy of a submission using information submitted by the applicant for the stages of site selection, construction and operating approval. Between site selection approval and construction approval the AECB presently requires an applicant to implement a public information program.

It is difficult to generalize about the "typical" licensing process. Depending upon the nature of the facility, the process can be short in duration or extend over long periods of time. In the Lepreau case, the formal notice of intent was received by the AECB in February, 1974. Site approval occurred in October, 1974, and a construction licence was issued in May, 1975. But for nuclear-powered pacemakers, involving a novel technology and difficult control problems, the initial licensing process lasted two years.

The licensing of radioisotopes, on the other hand, is excepted from elaborate review by an RSAC or its equivalent. These applications are handled by the agency's Administrative Division that ensures the information submitted is adequate and that licensing criteria are met. Some 2,000 routine licensing decisions of this kind have been made annually by the agency in recent years.

The *Atomic Energy Control Act* has largely left the AECB free to develop its own procedures. Section 8 of the Act empowers the AECB to

> make rules for regulating its proceedings and the performance of its functions.

More restricted, since the approval of the Minister is required, is the agency's capacity to disseminate information about atomic energy. But how this is done is left for the agency to decide—to such extent, and in such manner as the Board may deem to be in the public interest.[9] Section 9 of the Act allows the AECB, given the approval of Cabinet, to make regulations

> for the purpose of keeping secret information respecting the production, use and application of, and research and investigations with respect to, atomic energy, as in the opinion of the Board, the public interest may require.

Concern with security no doubt also motivated our legislators' view of how the AECB should operate. Public proceedings and "judicial" techniques of fact-finding and adjudication were not perceived as necessary agency decision-making tools. Hence, the AECB is not a court of record. Nor does or must the agency hold regular public hearings when formulating regulations or considering licence applications. However, its regulation-making functions are governed by provisions of the *Statutory Instruments Procedures Act* that, for example, require advance publication in the *Canada Gazette*.

More protections are available to licensees facing a possible change in status. Recently added provisions to the Atomic Energy Control Regulations[10] require that the AECB give notice in writing to the holder of any licence that may be revoked, suspended or amended. However, emergency provisions permit the AECB to act without notice if public safety warrants, although if this happens a licensee or ex-licensee may request an inquiry.[11] Reasons for the revocation, suspension or amendment must be given in writing. Furthermore, the licensee must "have been given reasonable opportunity to be heard by the Board,"[12] an opportunity that would not include a public hearing.

Other formal procedural norms, to be examined later, also guide AECB processes. Yet the lack of statutory direction on agency procedures is striking in contrast to other federal regulatory agencies and particularly American nuclear regulatory processes. These have more stringent and public regulation-making and licensing procedures[13] derived both from enabling statutes and the general procedural requirements of the *Administrative Procedures Act*. They are more formal, more open and more unwieldy. For some, they are attractive as an alternative model.

The Atomic Energy Control Regulations not only set out the agency's licensing procedures and requirements but also state maximum health and safety limits for radioactivity released by prescribed substances and facilities. These limits flow largely from the recommendations of the International Commission on Radiological Protection (ICRP) and are based

on maximum radiation levels for exposed individuals. The AECB has recently established a design and operating target of one per cent of the maximum permissible exposures by gaseous or liquid effluents for the activities it licenses.[14]

The transportation of prescribed radioactive substances is regulated both directly and indirectly by the AECB. Direct control through the Atomic Energy Control Regulations requires shippers to comply first with regulations of transportation safety authorities, but when these are lacking, to follow AECB's requirements. Indirect control stems from AECB's role as technical adviser to federal departments and agencies regulating rail, marine, air and postal modes.[15] Road transport continues to be handled by the AECB on a temporary basis pending promulgation of detailed regulations by provincial authorities.

The transport regulations developed so far require that packages containing radioactive materials meet certain performance standards designed to ensure that normal and accidental transport conditions do not result in any significant loss of shielding and containment. Shipping procedures must also comply with prescribed standards.

By far the largest part of the AECB's budget has been spent on grants for research in atomic energy. Obviously an important aspect of the AECB's mandate, these grants have been awarded annually following recommendations by a joint National Research Council (NRC) and AECB committee. In the past, these research grants have apparently concentrated on pure (high energy physics) research. Recently, however, the AECB has handed over this "pure research" granting role to NRC, deciding to devote its grants to applied research needed for the agency's regulatory role.

The AECB will also have responsibilities under the *Nuclear Liability Act* once this statute is proclaimed. The Act makes operators of nuclear installations absolutely liable for injury or damage resulting from nuclear incidents and requires them to carry $75 million of liability insurance. The Act also provides for compensation by the government in the event of a major nuclear incident. At the time of writing, unresolved insurance problems were delaying proclamation.

Obviously, its statutory mandates influence what the AECB does. But so too do ministerial and cabinet policies. In recent years, two policy statements, one on uranium and the other on safeguards, have directly affected the AECB's role. Indirectly, of course, such policies also condition and reflect the broader political and economic environment within which the AECB functions.

The statement in 1974 on Uranium Policy by EMR Minister Donald Macdonald outlined measures protecting Canadian uranium consumers given heavy demands from other countries for long-term supplies of Canadian uranium. The policy aimed at ensuring a long-term reserve of nuclear fuel for existing and committed reactors as well as for planned reactors for a ten-year period into the future. A second thrust of the policy was to ensure that sufficient uranium production capacity would be available for the Canadian domestic nuclear power program to reach its full potential.[16]

Because of this policy statement (as opposed to a statutory instruction), the AECB now requires a utility to demonstrate that it maintains a contracted forward supply of nuclear fuel enabling each operating reactor to be operated at 80 per cent annual capacity for at least 15 years (or for reactors committed but not yet operating for 15 years from their in-service dates). In addition, the AECB and other regulators of exports must now consider, in reviewing application for export licences, the adequacy of the applicant's uncommitted uranium reserves to meet its share of the Canadian domestic reserve margin. Although these policies have not been enacted as statute or regulation, they are considered to have the force of law because of the AECB's statutory duty to comply with any general or special ministerial direction.[17]

A further example of policy statements influencing the AECB's mandate arose in EMR Minister Macdonald's statement on Safeguards of December 20, 1974. Here, the Minister elaborated and reinforced Canadian international undertakings to ensure peaceful use of nuclear energy. These had been enunciated earlier, particularly in Canada's commitment to the Non-Proliferation Treaty. India had recently exploded a nuclear device, apparently using Canadian technology and developed in breach of the "peaceful purposes" undertaking in a Canadian-Indian agreement. This event, coupled with growing international demand for CANDU, raised doubts about the adequacy of nuclear safeguards.

The Non-Proliferation Treaty had already imposed obligations on the Canadian government and the AECB to assist and comply with inspections carried out under the terms of the treaty by the International Atomic Energy Agency (IAEA). The policy statement on safeguards sought to impose an even stricter regime. First, all future agreements concerning safeguards arrangements for the export of nuclear technology were to contain assurances that Canadian-supplied nuclear material, equipment and technology would not be used to produce a nuclear explosive device, whether or not the development of such a device was considered to be for peaceful purposes.

The policy also requires all potential Canadian exporters of nuclear material, equipment or technology to ascertain from the Department of Industry, Trade and Commerce and the AECB that there would be no safeguard problems before making offers of supply.

Such policy statements have not only influenced the AECB's behaviour but also cast the agency in the role of advisor to the Departments of External Affairs and EMR. The delicate domestic and foreign policy balancing that shapes the environment in which the AECB functions was described in a speech by Prime Minister Pierre Trudeau on June 17, 1975 to the Canadian Nuclear Association. He summarized Canada's nuclear policy obligations to include assisting developing countries, ensuring stringent safeguards, and supporting domestic technological capability in an industry in which Canada internationally has an important competitive advantage. In the Prime Minister's words:

- By caring for others, by sharing what we possess and others need, we are fostering the spirit of hope and easing the quest for social and economic justice now so prevalent in so many countries.
- By insisting on the most stringent of safeguards and precautions we are attempting to ensure that the nuclear genie will not escape from the constraints demanded of it and bring suffering to future generations.
- By encouraging Canadians to engage in what they do best, by supporting initiative and competence in technologically advanced fields, we are contributing confidence to a new Canada, one that I have described as being on the threshold of greatness.[18]

C) Policy Controversies in Nuclear Energy

A description of the AECB's mandate as derived from statutory obligation, regulations and governmental policy statements is only a beginning. To understand the AECB's role, these statutory, regulatory and policy objectives must be brought to life within the contemporary context of the major controversies surrounding nuclear energy. Consequently, these controversies are referred to throughout this study. They are briefly mentioned here because they have served as the arenas in which the AECB, fairly or unfairly, has been assessed. Ironically, the major controversies have involved issues that the AECB could not, either constitutionally or practically, deal with independently. Others, however, concerned matters within the agency's regulatory sphere.

The controversies have raised some of the following issues:

a) the adequacy of health and safety standards regarding permissible exposures;

b) the adequacy of precautions against major reactor accidents, breakdowns or failures and the possible consequences of catastrophic accidents;

c) the adequacy of waste storage facilities of a temporary or permanent (for thousands of years) nature;

d) the adequacy of precautions against the theft of nuclear material and the precautions against nuclear blackmail by terrorist groups;

e) the proliferation of nuclear technology to states judged to be politically unstable;

f) the relatively more difficult problems in regulating and internationally inspecting CANDU as opposed to other nuclear systems because of on-power fueling and large numbers of spent fuel bundles; and

g) the relative cost, social and environmental impacts, of nuclear compared to other energy sources (coal, oil, hydroelectric, gas, solar, etc.).

This list of issues is by no means exhaustive.[19] It does, however, set nuclear energy policy issues, far more than most other policy issues, what one author has perceptively described as the politics of ''hypotheticality''.

> ''Hypotheticality'', of course, is not a word in regular usage but its logic expresses precisely what must be expressed ... here. Its logic is the same as that of the word ''criticality'', for example, a term which is familiar to reactor engineers. The rule followed is that for Latin words ending in -itas, for example, veritas or felicitas. Such substantives point to features which exist in principle and which, if actualised, lead to the fact that something can have a certain property: a reactor can become critical or a situation can be considered to be hypothetical. The process of iteration between theory and experiment which leads to truth in its traditional sense is no longer possible. Such truth can no longer be fully experienced. This means that arguments in the hypothetical domain necessarily and ultimately remain inconclusive. I think that this ultimate inconclusiveness which is inherent in our task explains, to some extent, the peculiarities of the public debate on nuclear reactor safety. The strange and often unreal features of that debate, in my judgment, are connected with the ''hypotheticality'' of the domain below the level of the residual risk.[20]

For nuclear power and its regulation then, standards of proof and risk-benefit cannot easily or reassuringly be offered. The technological mystery of the nuclear energy regulatory process affects substantive standards and how they are perceived. Some judge the nuclear alternative to be too risky and thus seek its abolition. Others demand more convincing reassurance. And all of this inevitably influences how one measures the adequacy of the processes and procedures of nuclear regulation.

This chapter has described the statutory and policy mandate of the AECB in terms of substantive objectives and procedural requirements. Before relating these to the dynamics of the AECB's behaviour, it is necessary to acquire some understanding of the formal elements of the AECB's structure and organization.

CHAPTER II

The Formal Organization of the AECB

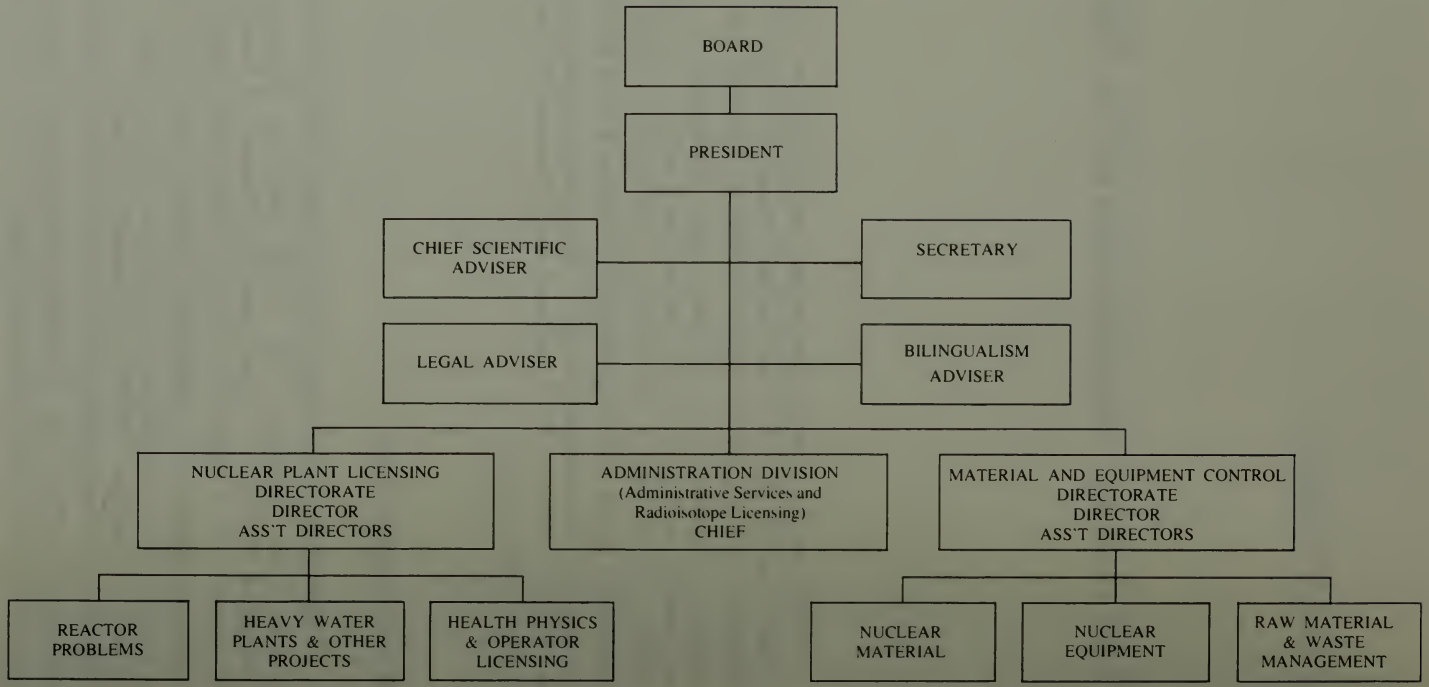
This chapter considers the broad characteristics of AECB organizational hierarchy, the role of its members, relationships between the AECB, Minister and Cabinet, the role of AECB Directorates and staff and its Advisory Committees. It includes some description of the agency's relationships with client groups and regulated sectors, the nuclear industry, federal and provincial departments, international agencies, university researchers, public interest groups and the media. Briefly sketched as well is the agency's reorganization in 1975. These formal organizational attributes are related in Chapter III to informal and behaviourial characteristics and tendencies of the agency.

A) Organization

Appointed to the Atomic Energy Control Board are one full-time and four part-time members.[21] The AECB reports to Parliament through a designated Minister, in recent years the Minister of Energy, Mines and Resources. As of March 31, 1975, the agency had a staff of sixty-eight scientists, engineers and administrative officers. The AECB's legal advisor is seconded from the Department of Justice. All but eight of the staff are located in Ottawa at AECB's headquarters. Seven officers are located in field offices at nuclear power plant sites. Recently an eighth field officer has been placed in Port Hope. Although a reorganization occurred late in 1975, the AECB's formal organization until October 15, 1975 is reflected in Chart I.

CHART I

ORGANIZATION CHART
ATOMIC ENERGY CONTROL BOARD
(before October 15, 1975)



The Board's staff is organized into four functional units, the President's Office, Administration Division, Material and Equipment Control Directorate (MECD) and the Nuclear Plant Licensing Directorate (NPLD). Of the sixty-eight staff members, five are in the President's Office, fourteen in the Administration Division, twenty in the MECD and twenty-eight in the NPLD. The AECB also relies heavily on appointed federal and provincial health authorities and inspection officers who have responsibilities under the Atomic Energy Control Regulations. The former (federal) advise on requirements for atomic energy workers and the latter (provincial) inspect, report and act on behalf of the AECB for licence compliance matters. Although inspection officers devote only part of their time to AECB responsibilities, their efforts constitute the equivalent of some twenty full-time people, almost all concerned with compliance.

The AECB is also assisted by the advisory efforts of other federal, provincial and municipal officials involved in interdepartmental and inter-governmental relationships. Advisors are appointed as individual experts to serve on *ad hoc* or standing safety advisory committees and to provide advice to the AECB on regulation-making and licensing.

In total, the AECB is a remarkably small organization. Although its professional staff has grown from forty-nine in 1972 to sixty-eight in 1976, the AECB continues to be spartanly staffed. Admittedly, its organizational tentacles to other departments and jurisdictions provide additional support. But as will be argued, there are dangers in relying too heavily on this "hidden" part-time staff.

B) The President and the Board Members

The President is the chief executive officer of the AECB and the only full-time member of the Board. Although appointments are at the pleasure of the Cabinet, the four part-time members are normally appointed for three-year terms.[22] One member must be the president of the National Research Council (NRC).[23] Until very recently, Board members were almost always the heads of the government entities engaged in industrial or research activities in the nuclear field. In addition to NRC's president, Board membership had always been conferred on the presidents of AECL and Eldorado Nuclear Ltd. Now, however, membership has been broadened. Members of the AECB, in early 1976, were:

Dr. A. T. Prince, President

Dr. W. G. Schneider, President, NRC

Professor L. Amyot, Director,
Institute of Nuclear Engineering,
Ecole Polytechnique, Montreal, Quebec

Miss S. O. Fedoruk, Director of Physics,
Saskatchewan Career Commission,
Saskatoon, Saskatchewan

J. L. Olsen, President and Chief Operating Officer,
Phillips Cables Ltd.,
Brockville, Ontario

These members meet about six times each year for a day-long meeting. A quorum of three is required.[24] Board members usually receive the agenda and supporting material about one to two weeks before scheduled meetings.[25] Part-time members appear to spend two or three days preparing for meetings. Preparation time may be augmented by the participation of members in AECB advisory committees.

Board meetings are usually held in Ottawa although in recent years some meetings have been held elsewhere, normally to coincide with a visit to a nuclear facility. In principle, and overwhelmingly in practice, the board does not actually hold formal votes to reach its decisions. All Board meetings are held in camera, as are the meetings of its advisory committees.

Board members have sought, particularly in recent years, to confine their deliberations as much as possible to broad issues of policy and the making of decisions on the siting and licensing of major facilities such as nuclear power plants. The bulk of routine licensing, for example, of isotopes is delegated to first and second level AECB staff.

C) Relationship to Cabinet and Minister

In formal terms, the designated Minister has the power to order the AECB to do his bidding.[26] The power to make regulations is shared with (and can be scuttled by) the Cabinet. For most of the AECB's existence, before it came under public scrutiny, the Minister/AECB relationship was somewhat distant, at arm's length, and confined to regular but fairly infrequent personal consultation between AECB's president and the then Minister. But in recent years, and particularly since 1973, more frequent and closer contact has occurred. This has happened because EMR has lacked its own nuclear expertise in the nuclear field and both department and agency have had to cope with the controversies described earlier.

The appointment in 1975 of Dr. A. T. Prince as president of the AECB (the first president not to have previously held a senior position in AECL) also signalled greater ministerial and Cabinet interest in the AECB. It is probably fair to say that ministerial policy influence on the agency is now as great as formal statutory direction. While the AECB is obviously not a blatant promoter of the nuclear industry, its research grant program for universities, its policy advisory and strategic functions require treading a fine line in advising the Minister of Energy, Mines and Resources and the Secretary of State for External Affairs, while at the same time regulating the nuclear industry. These varied and possibly conflicting activities are important factors in assessing the appropriate procedural independence the agency should have.

D) The Role of AECB Directorates

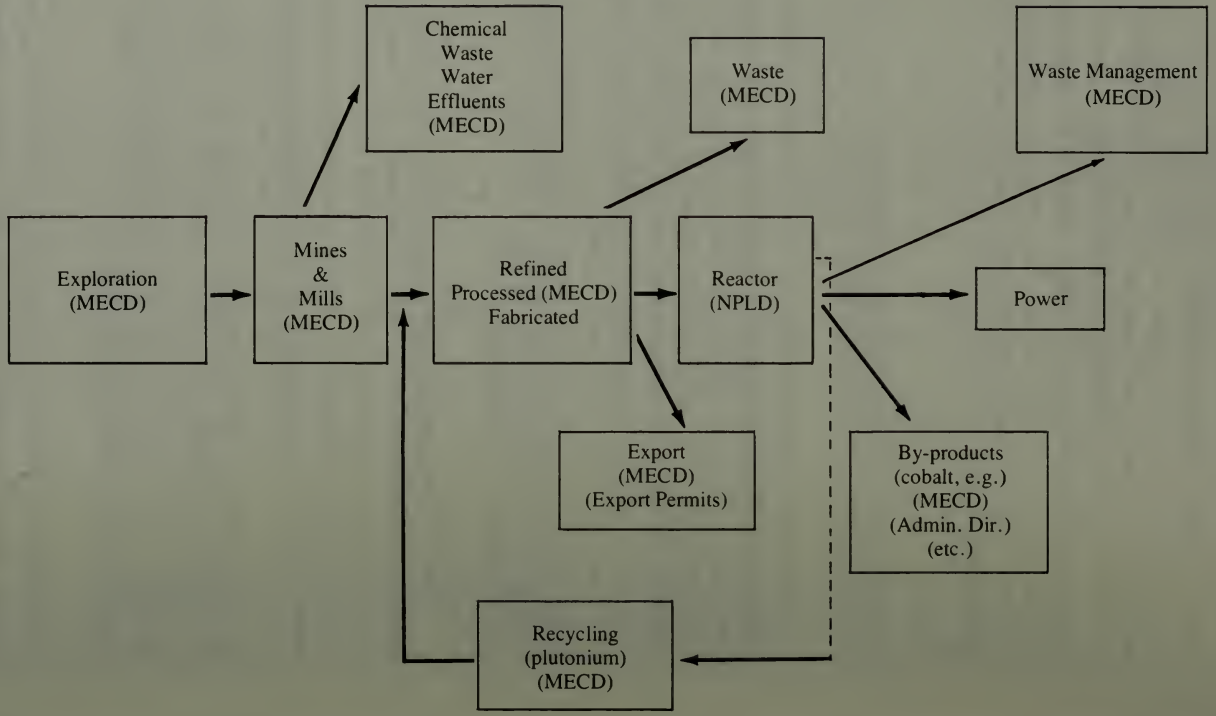
Some of the responsibilities of the Nuclear Plant Licensing Directorate (NPLD) and the Material and Equipment Control Directorate (MECD) are illustrated in Chart II. NPLD considers the licensing of larger power and reactor projects, heavy water plants as well as health physics and operator licensing. MECD deals with nuclear material and related safeguards, import and export controls, internations NPT as IAEA[27] and security matters. It is also concerned with equipment licensing, for example, of accelerators, transportation, isotopic equipment and devices as well as waste and resource management that encompasses facility exploration and mining licensing, and radiological environment questions.

Chart II illustrates the differences in NPLD and MECD roles in a basic fuel cycle for nuclear power. This encompasses what could be considered a fuel's life cycle beginning with exploration and mining then proceeding through refining, fabrication, use in reactor or other processes and ending in waste management and recycling. Chart II indicates the technological and physical flow of events requiring regulation, and indicates to some extent the many points at which regulators must intervene and about which they must possess adequate information. Other fuel cycles could be developed for such regulatory concerns as research accelerators and prescribed substances. Like Chart II, these would tend to demonstrate that MECD has a somewhat more diffuse role than NPLD.

In practice, the two directorates must work closely together. More staff work in NPLD than MECD (28 and 20). And this probably reflects the attention the agency has had to give to power reactors, by far the most visible part of its regulatory role.

CHART II

THE ROLES OF NPLD AND MECD DIRECTORATES IN A SIMPLIFIED MODEL OF A FUEL CYCLE FOR NUCLEAR POWER



MECD staff tend to be more influenced by policy issues. They must deal with areas lacking in many instances specific rules or directions. Examples are matters arising under NPT, safeguard questions and uranium export policy. MECD tends to have more diverse relationships with other government departments. NPLD deals more with Crown corporations and utilities (AECL, Ontario Hydro, etc.).

Functional differentiation is never watertight. These broad generalizations are also complicated by the role of the Administration Division. Although concerned with such matters as personnel and office services, this division's chief spends some eighty per cent of his time every year examining and processing about 2,000 fairly routine licences, mostly involving radioisotopes. A further anomoly in functional allocation is the handling of the research grants program — some eighty per cent of AECB's total budget—by the President on the advice of AECB staff and a special advisory committee. Some of these organizational anomalies have been reasons for a reorganization in 1975 that will be described later in this chapter.

E) The Role of Advisory Committees

As noted earlier, the AECB relies heavily on an elaborate network of advisory committees. Typically, these committees consist of individual experts and representatives of federal, provincial and some municipal departments and agencies. There are three major types of committees: Safety Advisory Committees (SAC's), Technical Advisory Committees (TAC's), Grants Advisory Committees (GAC's).[28] The committees provide the AECB with a diverse range of expertise on nuclear design, health and safety and nuclear research.

While the committees have no powers of decision, their influence can be decisive. An adverse judgment by a committee could mean a negative decision by board members. This is particularly so for the Reactor Safety Advisory Committees (RSAC). No approval of site, construction or operation has been given by the AECB without a positive recommendation from the relevant RSAC.

Other committees may be created in response to a particular need for advice. In 1974, for example, a Mine Safety Advisory Committee was created to advise on safety aspects of uranium and thorium mining and milling operations.[29]

The use of the advisory committees undoubtedly has many advantages for the AECB. It facilitates multi-governmental representation and cooperation as well as giving access to scarce expertise.

It is a mechanism that parallels the committee approach developed over the years by the NRC. In professional terms, it is a process of peer-group assessment. Thus far, the concept of representativeness on these committees has not been extended to other constituencies such as labour unions. This issue will be explored later as well as considering whether the cumulative effect of the use of committees, given the small size of the AECB staff, has left the agency in a vulnerable and excessively dependent position. The advisory committees constitute an important element of AECB organization, and their members represent a significant portion of the agency's hidden part-time staff.

F) The Clientele of the AECB

The AECB must interact with a wide range of clientele groups and organizations — the nuclear industry (the large state enterprises and the smaller nuclear parts and components industry), federal, provincial and municipal departments, international agencies like the IAEA, university researchers, recently emerging public interest groups and the media. Brief observations about the main characteristics of each of these constituents will hopefully serve as an informative background to later analysis.

(i) *The Nuclear Industry*

The Canadian nuclear industry consists of two kinds of enterprise. On the one hand are the large state-owned enterprises like Ontario Hydro, AECL, Hydro Quebec, New Brunswick Electric Power Commission and Eldorado Nuclear. On the other hand are the smaller, more numerous privately-owned companies, primarily involved in parts, components and fuel manufacture. This latter group is broadly represented by the Canadian Nuclear Association. Users of nuclear facilities and substances in universities, hospitals, health research centres and corporations could also be considered part of the "industry". Some of the issues concerning these AECB clients will be examined in the later section on university research.

Atomic Energy of Canada Limited (AECL) enjoys a pre-eminent position in the industry because of its pioneering role in Canada. Incorporated as a Crown corporation in 1952, AECL immediately took over the operations of the Chalk River project. The NRC had operated Chalk River under contract with the AECB since the beginning of Canada's nuclear program during World War II.[30]

AECL's objectives are to develop economic nuclear power; conduct scientific research and development in the atomic energy field; operate nuclear reactors and produce radioactive isotopes and associated equipment. It has major facilities at Chalk River, Whiteshell (Manitoba), Ottawa,

Toronto, Montreal, Glace Bay, Douglas Point and Gentilly. Until the middle of the last decade AECL tended to be dominated by its research role. However, with the successful development and deployment of CANDU, AECL has moved more into its role as producer and promoter of nuclear power.

Yet the importance of AECL to the nuclear regulatory process extends beyond its obvious roles. For a considerable period of time, AECL scientists and engineers were virtually the only source of trained personnel. Hence, AECL "graduates" populated the nuclear research establishments in universities, the early development of Ontario Hydro's nuclear power program (although Ontario Hydro also recruited heavily from the U.K.) and the AECB itself (including its presidents).

These career links, while not as closed and confined as they once were, must have shaped AECB activities. The presence of AECL's president as an AECB member symbolized this close relationship. But as long as the research role of AECL was dominant, and the nuclear professional community small, a close relationship was probably inevitable. However, the evolution of AECL, via CANDU, into a nuclear entrepreneur now makes the historic coziness of the AECB-AECL relationship unacceptable both in appearance and in substance. To this day, some of AECL's facilities are not licensed by the AECB, although steps are now being taken to correct this situation.

The AECB's other link with federal state enterprise is through Eldorado Nuclear Limited. Originally a private company, it was taken over by the Crown in 1944. Its function is to mine and mill uranium ores and to refine uranium concentrates to produce a purified oxide, uranium metal, uranium hexafluoride and zirconium. Although once as well the government's official purchasing agent for uranium under the government stockpiling program, this function has been carried out since 1971 by Uranium Canada Limited, a federal Crown corporation.

The president of Eldorado Nuclear was also a member of the AECB until March, 1974. In recent years, the regulatory issues related to uranium mining health and safety (particularly the health and safety of miners) have complicated Eldorado Nuclear's relationships with AECB. The apparently serious waste management problems at Eldorado Nuclear's Port Hope facilities reflect what has become a difficult relationship.[31]

The original and for some time the only provincial power utility in the nuclear business was Ontario Hydro. Its Pickering and Bruce plants remain as Canada's largest nuclear power plants. In the early 1970's, Ontario Hydro was joined by Hydro Quebec, with Gentilly 1 and more recently the Gentilly 2 plant. New Brunswick Electric Power Commission became the third provincial utility in the nuclear field with the recent issuance of a construction

licence by the AECB. Ontario Hydro clearly has most experience with nuclear power generation. As a result, it has performed critical advisory roles and provided some of its ''graduates'' to the Hydro Quebec and New Brunswick Electric Power Commission nuclear programs.

The importance of the utilities, especially Ontario Hydro, arises not just out of their obvious role as major power producers, and as buyers of CANDU technology, but also because of their place in the AECB's regulatory strategy. Like many regulatory agencies, the AECB has adopted an approach that places the utilities on the regulatory ''front line''. The AECB has adopted the view that the onus should be on the utility or other user to demonstrate to the AECB that health and safety standards are developed and followed. This, given Ontario Hydro greater operational experience with power plants, is a sensible practical arrangement. But it can also lead over time to a dependence by the regulator — AECB — on the expertise and even on the standards developed by the regulated utility. Such a tendency, however, cannot negate the usefulness of the ''front-line'' concept. Ontario Hydro has set up within its own organization an apparently effective, relatively independent and parallel health and safety mechanism to act as a check on line operators that is a model for other utilities.

The ''front-line'' concept has another feature that is only now emerging. The ultimate issue of whether to use nuclear or conventional sources of power cannot be determined by the AECB. All the AECB can do is to say, that if a utility (and the provincial government) decides to ''go nuclear'', then it must satisfy the board's health and safety requirements. Being on the ''front-line'' then will mean coping with debate over fundamental issues, debate that involves emerging nuclear public interest groups, debate that will be directed to the doors of the utilities and the provincial governments.[32]

Ontario experience so far has resulted in the passage of the Ontario Environmental Assessment Act[33] and the establishment of the Royal Commission on Electrical Power Planning.[34] Both of these developments will ultimately influence the regulatory process, but go well beyond the AECB ambit.

While the provincial utilities and AECL are the major forces in the Canadian nuclear industry, a large component and support industry has emerged in recent years.[35] This sector of the industry, largely privately-owned, is represented by the Canadian Nuclear Association (CNA). With 150 corporate and 97 associate members, CNA's board of directors includes the president of AECL and the chairman of Ontario Hydro.

The CNA is the most visible industry interest group. Its relationship to the AECB tends to be informal. AECB officials are frequently observers at

CNA meetings and are associate members of its Codes, Standards and Practices Committee. In addition, of course, many CNA members are AECB licensees. Informal consultative processes with the CNA are an inevitable and generally desirable way for the AECB to interact with the industry. Excessive dependence by the AECB on the CNA in the area of standards, of course, could be harmful to broader notions of the public interest.

The CNA has also become increasingly preoccupied with growing public concern about nuclear power. It has sought to avoid a repetition in Canada of the American anti-nuclear movement, a movement that in the CNA's view is prejudicial to the industry's interests. A major seminar and information program was begun by the CNA in 1975 to examine this growing public concern, to develop ways to allay public fears and to solve substantive problems in nuclear health and safety.[36]

(ii) *University Researchers*

The university research community, particularly in nuclear physics and nuclear engineering, has been an important constituency of the AECB. The agency's research grant program, recommended by the Visiting Committee and jointly sponsored by NRC and AECB, has stressed pure rather than applied research as opposed to mission-oriented research. Grants totalling $2,626,290 were awarded to universities in 1974-75.

The AECB's major grant has been to the TRIUMF (Tri-University Meson Facility) project located at the University of British Columbia. Also involved are the universities of Alberta, Victoria and Simon Fraser.

The AECB's concentration on funding pure research had been strongly supported by each of the agency's previous presidents. In 1975, a decision was reached under newly-appointed president, Dr. A. T. Prince, to alter the board's research priorities. Most of the existing grant program will be transferred to NRC leaving AECB with a research program aimed mostly at supporting its regulatory activities. The research funded is to be more mission-oriented. Implementation of the new policy is entrusted to a newly created Directorate of Research and Coordination.

The AECB's research funding function, both past and present, has important regulatory implications. In one sense, the old granting program could be seen as promotion of the development of atomic energy and competent research personnel. But the granting program could also be viewed as a means of co-opting the one pool of nuclear expertise, namely university nuclear physicists, capable of criticizing the state-owned industry centred on AECL. While this tendency will become less visible as a result of the decison in 1975 to transfer the granting program for pure research to NRC, it cannot be

eliminated overnight. Who else can undertake "mission-oriented" research and development for AECB but the very industry it regulates? There would appear to be no other available source of "independent" applied research capacity.

The federal government's "make or buy" research and development policy specified that departments and agencies should generally contract out their research requirements except when certain conditions prevail.[37] One of these conditions is when the research in question directly supports a regulatory function. The AECB in contracting out its mission-oriented research cannot rely as heavily on universities in the applied field as they could in the pure nuclear physics field. It will, therefore (at least initially), have to rely on the industry being regulated. The only other source of relatively independent expertise to which it would turn, on a contractual basis, might be the NRC. But the president of NRC is an AECB member of the board and conflicts of interest could arise. Even grants to universities with nuclear engineering departments could raise conflict of interest problems since representatives of such university programs may be (and currently are) AECB members.

It is, of course, difficult to find neutral expertise at the best of times. However, given the technologically esoteric area that AECB regulates, it is especially important to examine and structure the way in which relatively independent expertise is used by the agency and parties to its proceedings. Although the adequacy of research in such areas as waste-management, occupational health and safety can be questioned, this study focuses only on the processes through which the AECB acquires and uses research.

(iii) *Public Interest Groups*

The newest members of the AECB's constituency are what have come to be known as public interest groups. These groups have emerged in the last few years, first because of a general environmental concern and then specific concerns about nuclear energy. The most active groups range from Pollution Probe to newer groups such as the Maritime Coalition of Environmental Protection Associations, Energy Probe, CANTDU, and the Coalition for Nuclear Responsibility.[38] While the positions of these groups vary on particular points, most have adopted what the industry regards as "anti-nuclear" positions. They have attempted to persuade public authorities to consider and use non-nuclear energy alternatives, to conserve energy generally and to adopt open decision-making processes. Some have urged that a moratorium on nuclear development be declared pending further research, and pending a more open public debate about the advantages and disadvantages of nuclear energy. Memberships of these groups are not large; nor do they have adequate funding. Many groups have, however, articulate

and knowledgeable members who undoubtedly stand as an important and growing body of opinion about nuclear energy and its regulation in Canada.

The public interest groups tend to view the AECB as a regulatory anachronism. While acknowledging that the agency has provided them with information and numerous patient explanations of the AECB's role, the public interest groups consider the AECB as closeted with secrecy and lacking an independent perspective. Some spokesmen for the public interest groups have suggested that the AECB be abolished and its role given to a greatly strengthened federal Department of the Environment.

Other interest groups have also been active in the AECB's regulatory area. Labour unions have begun to interact with the AECB, particularly concerning the health and safety of uranium mining as case studies in the Appendix demonstrate.[39] Their presence clearly requires the AECB to develop new habits and modes of operations. They cannot be accommodated by the processes the AECB has been using with its traditional "technological" and scientific constituencies. It should also be stressed that the Canadian public interest groups do not possess (to date at least) the resources their counterparts in the United States have had, nor do the Canadian regulatory and legal systems provide them as much access to information, proceedings and remedies.

In the United States, a number of nuclear facilities have either been halted or significantly delayed because of public interest interventions and the widespread concerns these have provoked.

(iv) *Other Federal, Provincial and International Departments and Agencies*

A number of federal and provincial departments and agencies must logically be viewed as AECB constituents. The agency's staff spends a significant amount of time interacting with them. Furthermore, the AECB depends upon them for advice and part-time services. How these relationships have been created has already been described. Table I summarizes the general nature of the more important ones.

The extent of interagency and intergovernmental relationships cannot, of course, be captured by a mere listing. The list as a portrait of relationships indicates the extent to which the AECB's relatively (indeed remarkably) small staff must stretch its span of attention, time and expertise. The portrait reflects, moreover, the existence of an informal part-time staff whose duties are primarily in other units of government, but who also "service" the AECB in a wide variety of ways.

Table I includes the International Atomic Energy Agency, previously mentioned in Chapter I.[40] The IAEA can also, in part, be viewed as an

TABLE I

Summary of the AECB's Interdepartmental Relationships

Department or Agency	*Relationship*
Federal	
Energy, Mines and Resources	Mutual policy and technical advice
National Health and Welfare	Mutual advice, staff support from Radiation Protection Bureau
Environment	Environmental assessment of federally funded or initiated projects
National Research Council	Research grants, technical advice to AECB
External Affairs	AECB advises on technical aspects of nuclear policy matters, safeguard policy, Non-Proliferation Treaty
Industry, Trade and Commerce	Mutual advice; export licensing of uranium and other substances and equipment
Royal Canadian Mounted Police	Security and physical protection
Atomic Energy of Canada Ltd.	Technical advice from AECL experts; licensee
Eldorado Nuclear Ltd.	Advice on mining; licensee
Canadian Transport Commission	Transportation of nuclear substances
Ministry of Transport	Transportation of nuclear substances, air and marine
Department of National Defence	Defence and nuclear-powered submarines
Provincial and Local	
Variously, Departments of Health, Labour, Environment	Representation on advisory committees; provision of inspectors appointed by AECB, environmental assessment processes
Provincial Hydro Utilities	Licensees; Source of technical advice on standards and regulations
Urban and Local Medical Health Advisors, and Emergency Planners	Local health and emergency provisions
International	
International Atomic Energy Agency (U.N.)	International safeguards inspection and development of peaceful uses of nuclear energy
Nuclear Energy Agency (OECD)	Research and exchange of information
International Energy Agency	Research
International Committee on Radiological Protection	Standards, mutual advice
United Nations Scientific Committee on Effects of Atomic Radiation	Advice, information

agency servicing the AECB. IAEA inspectors visit Canadian nuclear facilities and analyze data submitted by the AECB on Canada's compliance with her treaty obligations on safeguards. However, some feel that the AECB relies too heavily on this international inspection and does not carry out enough of its own. In other words, the IAEA excessively "services" the AECB, establishing another form of dependence on external sources for measuring compliance.

Many of the questions surrounding the degree of dependence of the AECB on the IAEA, both for standards and compliance, are similar to those which surround the relationship between the agency and provincial utilities. To what extent must and should the board depend on "front-line regulators", domestic or international, for standards, regulations and compliance? To what extent does and should the AECB have a capacity and obligation for independence?

G) The 1975 Reorganization

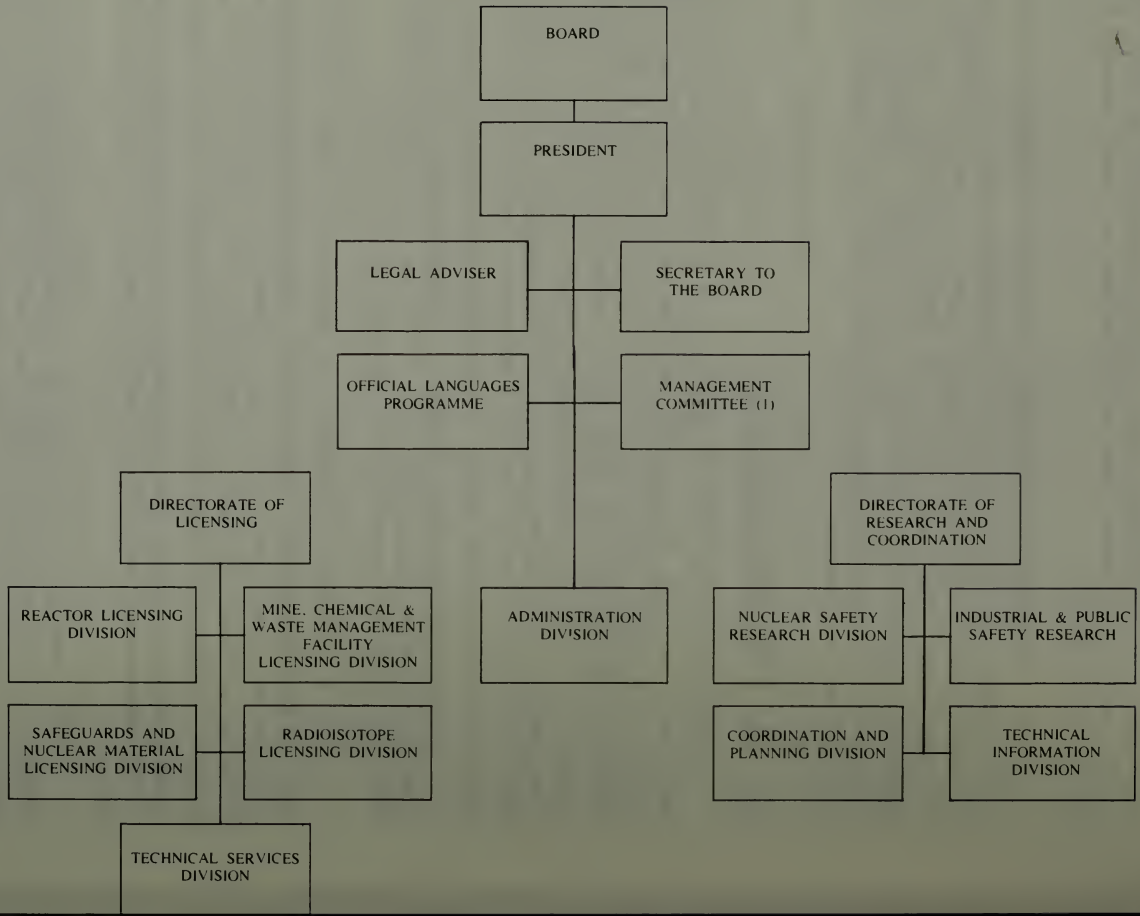
In recent years, the AECB has become very conscious of the changing environment in which its regulatory activities must be carried out. The media, for example, have only in the past two years begun to pay any attention to the AECB's role. Public interest groups have begun to involve themselves in a heretofore closed regulatory process. In this chapter we have presented the formal dimensions of the AECB's organization and clientele. The AECB has, however, recently announced a reorganization of the board's staff functions that perhaps reflects changing perspectives of its own role. The reorganization has obviously resulted from many of the issues described in earlier parts of this study. It follows a major internal review following the appointment of Dr. A. T. Prince as President in 1975.

Chart III indicates that NPLD and MECD directorates have been replaced by a Directorate of Licensing and a Directorate of Research and Coordination. The former will bring together all licensing functions (including radioisotopes) under a single director. The latter directorate, as its name indicates, will be involved in "the increasingly important area of mission-oriented research and development and of coordination of the AECB's relations at international, interdepartmental and federal-provincial levels".[41]

While it remains to be seen how the reorganization will effect changes in agency behaviour, that the AECB has decided to restructure its own operation to improve its capacity to cope with the current forces in nuclear regulations perhaps indicates that nuclear regulatory activities in Canada will expand in the near future. The AECB's capacity for change, of course does not depend only on its formal organization, but also on its informal characteristics.

CHART III

Organizational Chart
Atomic Energy Control Board
15 October, 1975



CHAPTER III

The Informal Organization of the AECB

The real processes and procedures of an agency that has operated for three decades are obviously a product of evolution and adjustment to changing conditions. This chapter analyzes a number of behavioural characteristics that form part of the informal structures of the AECB. It examines the general evolution of the agency, the relationships between laymen and experts in the regulation of a technologically complex field, the role and philosophy of AECB Presidents, the career patterns of board members and senior staff, the implications of the hidden part-time staff of the board, standard operating habits in regulation-making, licensing and compliance, the evolution of the agency's research and development involvement and the relationship between AECB and the Minister in an environment coloured by the high technology politics of CANDU.

A) The General Evolution of the AECB

The AECB was conceived in a post-war era dominated by strategic concerns about atomic energy. The Canadian nuclear community was a very small governmental community, confined to NRC and later AECL. The regulatory apparatus was, and probably had to be, a closed professional shop. The membership of the regulatory board and the career patterns of its staff reinforced and reflected the closed shop. As the nuclear community expanded from NRC and AECL to include Ontario Hydro and the physics departments of Canadian universities, a position was reached probably as early as the 1960s when the closed shop need not have existed. Security

concerns had moderated. The nuclear community was big enough to allow the AECB to have a much higher proportion of non-government representatives and experts. But the closed shop did not really begin to break down until this decade. It was also at this time that the CANDU nuclear power program began to have commercial viability.

The AECB has thus found itself in a process of evolution from being a strategic regulator and benevolent patron of nuclear research, to becoming an independent regulator in substance as well as appearance. Regulatory independence is, of course, never absolute in the Canadian context although other federal agencies have sought it with greater vigour than the AECB. All regulatory agencies in the Canadian system of responsible government are both dependent upon and controlled by a varying degree of ministerial and cabinet authority and power. So an agency's independence depends on both the agency's and the government's perceptions of the need for independence from industry or government dominance.

The AECB's dependence on its clientele for monitoring compliance is, however, not unique. Standards are usually set by agencies, and regulated industries bear significant responsibility for ensuring compliance whether the sector is transport, communication or oil and gas. Compliance, however, in atomic energy, differs in that the utilities and industries involved have had a substantial role in developing the standards they monitor (the "front-line" requirements). But of course all federal regulatory agencies must secure the cooperation of a host of other governmental agencies to carry out their tasks effectively.

While independence is clearly always a question of nature and degree, an observation of this study is that the AECB, despite recent steps in the right direction, has not yet achieved an appropriate degree of independence from the activities it regulates. The degree of independence is doubly important in Canada because the nuclear industry is largely government-owned. What results from this then is one "governmental" agency, AECB, regulating other "governmental" entities. Given government support of an entrepreneurial nature for CANDU, achieving a visible independence for the AECB is essential although difficult to achieve.

B) Science, Technology and Nuclear Regulation: Two Models

The evolving role of the AECB and the unique pressures that technological complexity places on the public's understanding and control

of nuclear energy regulatory processes can perhaps be clarified by identifying, for analytical purposes, two models of regulation. For want of better phrases we* will call these models the professionally-open model (Model I) and the democratically-open model (Model II). Many people directly involved with nuclear regulation in Canada have these models in mind (either implicitly or explicitly) when commenting upon or considering possible reform. Both deserve thoughtful analysis. [42]

Model I, the professionally-open model, is a model of regulation characterized by a high degree of trust. Its proponents assert that it is *internally* open, fostering frank criticism and evaluation among professional and technically competent people. Advocates of Model I suggest that regulators using this model are viewed by regulated utilities as professionals trying to achieve common goals, health and safety, as well as production. As a result, professionals in the utilities are more likely to reveal to their regulating peers both what is working well, as well as what isn't. Problems are then dealt with internally and efficiently. An internal but professionally-open and frank process of evaluation promotes, it is argued by some, effective regulation by expert professionals who know what the problems are. Model I is also characterized by minimum reporting requirements and few public hearings. "Front-line" regulators (the professionals in the utilities) have as a result more time to spend on "real" health and safety, public interest issues. In other words, less time "pushing paper" to the regulatory agency merely to comply with formal requirements, means more time on actually meeting real health and safety needs.

Model II, the democratically-open model, parallels the nuclear regulatory regime in the United States that allows broad participation in regulation-making, licensing and compliance proceedings. Extensive hearings are a component of Model II. So too are greater opportunities for interventions and judicial review. Model II's opponents claim that it promotes confrontation. Regulatory professionals would be viewed by their peers in the utilities as "them and us" and frank communication could be jeopardized. In day-to-day regulatory and compliance relationships, regulators would be more likely provided only with the information required. The procedural requirements of Model II would mean more time being spent by regulators and regulated in complying with more extensive reporting and procedural requirements.

Both models are, of course, oversimplifications of actual regulatory processes. However, they do reflect the relative costs and benefits involved. And actual processes usually fall somewhere between these two extremes.

An observation of this study is that the AECB is moving and should continue to move towards Model II. Professional relationships are too cozy

*"We" refers to the author and his research associates.

for any real or perceived regulatory independence. But an evolution towards Model II cannot be achieved without costs. The democratically-closed, but professionally-reliable model that Canada has adopted has had benefits. One might be Canada's more stringent requirements for possible reactor breakdown. These might not have emerged without close professional contact. Less onerous regulatory requirements of a formal nature and active informal contacts may well have encouraged utility professionals to deal with the substantive "front-line" problems of health and safety.

It is apparent, though, that there is a very fine line in external appearance between professionally open and frank exchanges, and professional compromise. And this line is even more difficult to trace in what appears to be a technologically complex and scientifically mysterious area of regulation. Admittedly, all regulatory areas have an aura of complexity and mystery. The regulation of broadcasting and the regulation of atomic energy involve a number of similar basic issues but people have more difficulty, perhaps because of novelty, in understanding the problem of nuclear energy than the problems of broadcasting. But this marginal degree of difference imposes additional obligations on nuclear regulatory authorities to establish greater independence and to create more open regulatory and compliance processes so that better public understanding is achieved and health and safety standards are seen as being met.

These additional obligations are rendered even more imperative by the uncertainty that seems to pervade available knowledge on nuclear power. The problem of hypotheticality discussed earlier in this study contributes to public unease with closed decision-making. Important issues of nuclear regulation are debated without standards of analysis that allow definite answers.[43] Nuclear reactor breakdowns, nuclear disasters and waste storage in geologically safe caves are issues that take both regulators and public into unknown areas — and raise the problem of hypotheticality. More than other regulatory agencies in Canada, the AECB must tailor its processes to the realities of its regulatory environment. It must resist the natural professional temptation to think that because an issue is scientific, it ought not to be publicly discussed for fear that laymen will not understand or will develop irrational or hysterical fears about improbable consequences.

C) AECB Leaders

The AECB's historical reliance on Model I has been a product of the post-war security concerns that spawned the agency, the small size of the Canadian nuclear community for much of the AECB's history and because most of the entities involved are state agencies with the traditional Canadian

proclivity for secrecy. Reliance on Model I was reinforced by AECB presidents General A. G. L. McNaughton, Dr. C. J. Mackenzie, Dr. G. C. Laurence, and Dr. D. G. Hurst. General McNaughton was president for only two years (1946 to 1948). More influential were the three presidents who follow him.

Dr. C. J. Mackenzie was president from 1948 to 1961. An engineer, he was instrumental as president of NRC in developing nuclear energy in Canada. While president of AECB, he was also president of AECL in 1952-53. His active involvement in encouraging Canadian nuclear research led him to use NRC's concept of advisory committees in the AECB.

Mackenzie's successor in 1961 was Dr. George C. Laurence. Formerly with NRC, Laurence was a physicist specializing in radium and X-ray research who was director of research and development at AECL before his appointment as AECB president. In his eight years as president, because of his own expertise and interests, Laurence developed the AECB's competence in health and safety and also took a strong personal interest in the agency's research grants program.

Another AECL "graduate", Dr. D. G. Hurst succeeded Laurence. Also a physicist, Dr. Hurst's career went back to the origins of Canada's nuclear program. At AECL he had been director of reactor research and development. Following two years with the IAEA in Vienna, he became in 1967 director of applied research and development at Chalk River. As AECB's president until 1974, Dr. Hurst brought to the agency a continuing interest in the nuclear power reactor program and international safeguards. He also maintained the strong interest held by his predecessors in AECB's research grants program.

The appointment of Dr. A. T. Prince in 1975 broke the previous mold for ABCB presidents. He is the first appointed without direct career links to AECL. A geologist, Dr. Prince spent twenty years in various scientific management positions in the former Department of Mines and Technical Surveys, EMR and the Department of the Environment. From 1973 to 1975 he was Assistant Deputy Minister (Planning and Evaluation) in EMR. Although Dr. Prince possesses expertise in the development of radiation monitoring equipment, he is the first president who is not a nuclear expert. He brings to the agency a broader experience, knowledge and contacts with a number of federal departments that have interests in the Department of Energy, Mines and Resources, as well as in nuclear regulation. His previous experience with applied research undoubtedly influenced his views of AECB's research program. One of the AECB's earliest decisions under Dr. Prince was as mentioned earlier, to shift the grants program away from pure research towards applied research supporting the agency's regulatory

functions. This was also reflected in the 1975 reorganization of the board described in Chapter II. Dr. Prince assumed his duties with a commitment from the government that the AECB had to change significantly if it was to cope with its growing regulatory responsibilities.

D) Career Backgrounds of AECB Members and Staff

In addition to the five presidents, there have been fifteen other board members appointed to the AECB since 1946. On average, these members have served for about eight years, with some notable exceptions. J. L. Gray, president of AECL and W. K. Gilchrist, president of Eldorado Nuclear served on the board for fourteen years. Successive NRC presidents have been board members as statute requires. For the past thirteen years, two academics from Montreal's Ecole Polytechnique have been board members. However, the board has always been dominated by members from government agencies although one member has always come from a university.

In terms of discipline or professional background, four part-time members of the board have been engineers, three chemists, one physicist, one metallurgist, and six executives or managers. Interestingly, many board members have served, before, during or after their tenure on the board on the AECB's advisory committees.

Current members recognize the inappropriateness of having presidents of AECL and Eldorado Nuclear on the board. The presence of parties with such a direct interest in the nuclear industry cannot help but influence the agency's behaviour.

Given as well the technical, scientific and industrial backgrounds of the AECB's staff, and the part-time association of four of the agency's "directors", we can ask how independent any board can be, whatever its composition. A passive board will inevitably be motivated by agency staff and the media. If board members (and staff) all have scientific, technical and industrial backgrounds, how often will other sorts of issues be considered, in advance of public and media pressures? At present, no board members have legal backgrounds, social science backgrounds nor any expertise in broader environmental or health matters. No board member has ever had a labour union affiliation.

A five-member board, of course, could not possibly capture all useful attributes and representative characteristics. Nor could it really acquire even some of them as long as most members are part-time members.

The fact is that these members are not so much part-time members of the board as they are "over-time" members. One could add certain attributes to the board by enlarged part-time membership but this would likely be a cosmetic change. The only real alternative is to add several full-time members if the agency is to acquire a broader perspective at the top.

That the agency's staff tends to have engineering and science backgrounds is natural and necessary given AECB's responsibilities. Nevertheless, staff expertise may be too narrowly focused. Many staffers believe that the AECB is short on expertise in the health physics, environmental and social sciences areas.

Historically, the agency has been blessed with a very low turnover of staff. Staff members seem to have a genuine commitment to their regulatory role and to the professional development in the public interest of the highest standards of health and safety. This commitment has frequently been tested by the attraction of superior salaries offered by the utilities and the private sector. Genuine interest in the work of nuclear regulation, as well as opportunities to do a reasonably wide variety of tasks in a relatively small organization, have made the AECB a superior alternative for many staffers.

The recruitment patterns of the agency reveal a considerable and continuing dependence on the industry. Since 1970, for example, thirty-three new professionals have been recruited, including eleven from AECL, three from Ontario Hydro, seven from federal departments, four from Canadian General Electric, two from universities. This degree of dependence is a reduction from earlier periods, but still illustrates that the sources of qualified manpower are still limited. While the Ecole Polytechnique, McMaster University and the University of Toronto have programs, universities appear not to be producing enough qualified people. And as a result, the AECB must look largely to the industry. Recruiting from the industry is not, of itself, bad of course, but it does implant approaches and relationships that condition the agency's independence.

A short supply of qualified personnel generally has important consequences for nuclear regulation. The AECB is probably understaffed now. As its regulatory processes and functions expand, what then? Its American counterpart has twice the staff for a similar workload (after accounting for such variables as a larger population, more utilities and the three nuclear technological systems dealt with by the U.S. agency). With Ontario Hydro, Hydro Quebec, New Brunswick Electric Power Commission and other enterprises of the Canadian nuclear industry all competing for scarce nuclear engineering, physics and health physics professionals, the problem could become acute.

However, the degree of manpower shortage was assessed very differently by people interviewed during this study. The matter deserves serious analysis by nuclear authorities affecting as it does their future regulatory competence as well as any procedural changes the AECB may introduce.

Short supply in full-time staff, of course, increases AECB's dependence on its small army of part-time (or rather over-time) personnel. These people serve on advisory committees and handle what this study observed to be too many compliance and inspection functions. Part-time advisory and compliance processes can be helpful but the part-timer does not possess the same loyalty and visible identification to regulation in the public interest by the AECB as the full-timer.

Reliance on part-timers to some extent stems from the AECB's reluctance to tread too heavily in areas involving health matters that some consider to be within provincial jurisdiction. As a result, the agency has relied on part-time provincial health personnel. This, it is generally acknowledged, has led to uneven performance at best, and non-existent at worst. The real day-to-day compliance and inspection processes and functions of the AECB are too important to be sacrificed at the altar of jurisdictional uncertainties. The AECB has constitutional authority to appoint its own inspectors and compliance officials. After all, regulation means very little, especially in a technologically complex field, unless it is accompanied by a visible and real compliance capability, fully or largely identified with the board. The AECB possesses such a capability in the area of licensed major facilities. It does not possess such a visible capability in the more routine but far more numerous functions associated with other nuclear facilities and substances, such as uranium mining and radio isotopes. What activities are undertaken to carry out this "hidden half" of the AECB's role are carried out for the most part by "hidden" part-time staff as well.

At all levels of the AECB, the board itself, its central staff, and its field and compliance staff, the need is for more personnel. It is surely a paradox of contemporary Canadian government that while some parts of the federal public service, primarily in the regular departments, are grossly overstaffed, other areas such as regulatory units, are seriously understaffed. The danger about current outcries against general bureaucratic growth is that it may result in the baby being thrown out with the bath, at least as far as nuclear regulation is concerned.

E) Standard Operating Habits

Every organization develops its own standard operating habits. It needs such habits largely to help it pursue goals and also to reduce the areas of uncertainty presented both by its statutory and policy mandate and by its organizational environment. An examination of these habits helps to tell how the organization perceives and defines its own role. Consequently, several observations about the AECB's standard operating habits are illustrative.

First, historically, the agency has perceived its constituency to include only the utilities, other government departments and nuclear experts. For example, from 1970 to 1974, the AECB undertook the first comprehensive revision of its regulations. Although a major regulation-making and review exercise of significant public interest, it was carried out largely within the confines of the AECB's traditional constituency. Little thought was given to holding broader public hearings or meetings despite the fact that concern over nuclear issues was growing. Nor was there consideration of the usefulness of consultative processes that have proved beneficial for other regulatory agencies such as the CRTC, even though the AECB has the power to implement procedures of this kind. Yet, the AECB has relied almost exclusively on its advisory committee process and the intergovernmental and expert (peer-group) participation and representation it allows.[44]

Second, an examination of AECB budgets by themselves encourages the observation that the AECB has primarily been a benevolent patron for pure nuclear physics research in Canada. About eighty percent of its financed resources have gone to its basic research-oriented granting program. This has contributed greatly to the agency's historic image as a quasi-promoter of the industry. Yet the disposition of the granting budget takes only a few days of the agency's time, while the remaining ninety-nine percent is devoted to the agency's regulatory functions that consume the twenty percent of its budget that is left.

The informal characteristics of the AECB have not evolved in the three decades of its existence in a way that allows the agency to stand up well when measured against contemporary standards concerning regulatory processes. It has been formally and informally a relatively closed shop. Fortunately, the agency can control many of its own processes and procedures. Indeed, it has in the past two years begun to modify its habits but further changes are necessary and should be encouraged.

CHAPTER IV

Concluding Observations

Underlying the concluding observations in this chapter are two assumptions. These are, first, that the AECB will continue to exist, and second, that its responsibilities will grow as the Canadian nuclear industry expands. Suggestions for procedural reform can generally be directed to the AECB itself, although some would necessitate Cabinet support to be implemented because of budgetary and statutory requirements.

Much of what is suggested in the following pages would continue in an accelerated fashion the important changes that the AECB has itself set in motion during the past year. These suggestions for procedural reforms are based generally on criteria of greater openness and independence. These are judgemental criteria that can obviously be perceived in different ways, but are important standards, however, against which all regulatory agencies should be judged in a democratic state. We* have stressed that the AECB has additional obligations because its regulatory domain is characterized by greater technological complexity than others. It is, moreover, regulating an industry largely dominated by state enterprise and state entrepreneurs. So while state enterprise promotes nuclear energy, it is also being regulated by the state. There are clearly compelling reasons why Canadian regulatory processes for nuclear energy must be open and independent as well as appearing to be open and independent.

Accordingly, we* offer a number of observations and suggestions about the composition and size of the AECB, its regulation-making licensing and appeal processes, its staff, its public information function, research and development contracting process, and the relationship between the AECB and its Minister and the Cabinet.

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*"We" refers to the author and his research associates.

A) Composition and Size of the Board

Strong arguments support increasing the size and altering the composition of the membership of the AECB. The part-time members of the Board are not really part-time members. They are "overtime" members with primary obligations to their full-time occupations. This is not to question in any way the dedication or abilities of board members. We merely suggest that they cannot possibly devote the necessary time to give the board an active role in regulation. It is suggested, therefore, that the size of the board should be increased, perhaps from five to seven members. But three members, including the president, should devote their full time to the AECB.

The composition of the board should reflect a greater commitment to independence and representativeness. The decisions in recent years by the board and the Minister not to appoint the presidents of AECB and Eldorado Nuclear to the board should be cast as a general principle enshrined in the agency's empowering statutes. The principle should apply as well to the president of NRC. Although the NRC does not have the same identification now with the nuclear industry that it once did, excluding its president from the board of AECB would serve to separate at least visibly the government scientific establishment from all nuclear regulation. More positively, such an exclusion might also enable NRC to play a more active role as a source of independent scientific advice secured by the AECB on an open contractual basis. This, in turn, could lessen AECB's dependence on the nuclear industry for the applied research needed to support its regulatory functions.

A larger board would also enable the AECB to include in its membership people with a wider range of background experience and qualifications. Thus, the Board should include persons with backgrounds in law, health physics, environmental science and organized labour. Their presence would probably increase the capacity of the agency to consider and to exercise the full range of its regulatory mandate.

B) Regulation-Making Processes

The general review of regulations carried out by the Board, from 1970 to 1974, the *Uranium Mining Safety Case* and the *Nuclear Powered Pace Maker Case,*[45] all reflect an ingrained operational habit of the AECB. Its consultative and regulation-making processes tend to be confined to a closed network of experts and representatives of federal, provincial and local governments. These processes can and should involve a wider range of interested groups and concerned individuals.

Accordingly, we* would suggest that the AECB's general health and safety regulations be reviewed at least once every five years. The review procedures should require wide advertisement, public meetings or hearings and encourage the submission and discussion of briefs and opinions. Opportunities for public review should also accompany agency consideration of proposed regulations whenever this occurs.

C) Licensing Processes

The *Lepreau Case* clearly demonstrates the haphazardness of the total licensing process, and especially environmental assessments of major nuclear facilities. The relationships between the AECB and environmental departments need to be greatly improved so that their respective regulatory requirements can be timed, ordered and effectively implemented. At the same time, these relationships should be open enough for the public to scrutinize and participate in a meaningful way as important decisions are made. Opening licensing and other regulatory processes in this fashion will exact costs. But there are corresponding benefits in the quality and accuracy of decisions reached and in the acceptance of these decisions as legitimate products of public decision-making processes.

We* think it imperative that licensing procedures for major nuclear facilities include a requirement that the AECB must publicly, in all media, announce at the earliest possible time the intention of a provincial or federal utility to site, build and operate a nuclear reactor. This should occur when the agency (or its staff) receive an "informal" statement of intention, that could, if necessary, be requested. AECB licensing procedures should ensure that meaningful public consideration of a planned reactor occurs at an early stage in the approval process. One method would be to include the requirement that applicant proponents of nuclear facilities must satisfy the agency that adequate public scrutiny has occurred before any site is approved to assist in this. The AECB should ensure that the reports of its Reactor Safety Advisory Committees are made public as soon as possible.

D) Appeal Processes

The AECB issues about 2,000 routine licences annually in addition to licensing major facilities. These are scrutinized on a routine administrative basis. Public processes for routine licences would be administratively impossible. Some feasible public scrutiny could be encouraged, however. Wider circulation of information about routine licensing would help.

*See Editor's note, page 41.

AECB's regulations now permit a licensee whose licence has been revoked or suspended to appeal to the agency. These occasions are rare but important. The AECB's consideration of such an appeal should be held in public.

E) Staff Support

This study and the case studies appended to it observe in several contexts the extent to which the AECB is understaffed and the degree to which it relies on appointed part-time or rather "overtime" people in its advisory committees and compliance processes. Just how many regulators and inspectors the AECB should have are questions beyond the scope of the paper. But at one end of the spectrum, one could envisage an entire regulatory army in the field, paralleling and perhaps duplicating the industry being regulated. At the other end of the spectrum, one can imagine a regulatory apparatus with no enforcement capability, relying entirely on industrial self-compliance. These models are obviously extremes. At present, the AECB approximates far too closely the latter model.

Without suggesting numbers, we* found the AECB's need for significantly more professional staff at headquarters and especially in the field to be obvious. Additional staff would allow the Board to

a) reduce its reliance on part-time compliance personnel drawn from other jurisdictions;

b) promote the visibility and effectiveness of the Board's compliance function; and

c) give more detailed attention to all aspects — technical and participating — involved in the licensing of major nuclear facilities as well as in the more routine, and more numerous licensings of smaller nuclear facilities and substances.

The AECB does not need an army, just a visible platoon.

Staffing problems will be difficult to resolve in the short run because of increasing competitiveness within the growing nuclear industry for qualified and experienced personnel. In the longer run, ways of expanding the supply of qualified personnel must be explored.

F) Public Information Function

An increase in staff and resources will also be necessary to enable AECB to serve as a reliable source of independent public information on

*See Editor's note, page 41.

nuclear regulatory issues and licences. This is an essential activity if the public is to understand the issues and processes of nuclear regulation.

G) Research and Development Contracting Processes

The AECB has taken a desirable and necessary step in its decision to focus its research and development on areas related more directly to its regulatory mission. The independence of the agency becomes questionable, however, if this research is carried out within the very industry AECB is supposedly regulating.

As a matter of principle the AECB should ensure that its applied research and development needs *not* be contracted out to the nuclear industry. Admittedly alternative sources of expertise in the applied field outside the industry are few. The universities have concentrated on nuclear physics, perhaps in response to previous AECB funding. We would suggest that the AECB ask the NRC on an open contractual relationship basis to conduct at least some of the independent analysis needed by the AECB in the next few years. The real and perceived independence of the AECB are linked very closely to the processes it uses to fund research. Historical coziness now requires that the agency develop an arm's length relationship with the entities it has been more closely associated with in the past.

H) Relations with Minister and Cabinet

The policy relationships between the AECB, its Minister and the Cabinet are, in principle, appropriate and desirable in Canada's system of responsible government. But these relationships can place the AECB in situations that appear to strain its independence and make it difficult for the agency and its Minister to understand each other's behaviour and expectations. In the *Uranium Mining Case,* for example, the Minister's decision to leave inspections largely to provincial authorities made it very difficult for the AECB to monitor compliance in situations where agency standards were not likely to be met.

In the recent Port Hope controversy, both the Minister and the AECB were in the awkward position of having both the regulations and the possible offender (Eldorado Nuclear Limited, whose waste management practices were under attack) reporting to the Minister. Such a situation suggests a need to clarify the ways in which an agency like the AECB accounts for its regulatory performance. Any method used for such a purpose should allow

public scrutiny of the relationship between the regulatory agency and the responsible political authority involved.

We* believe that the suggestions in this study for procedural reform would help ensure that the AECB becomes a more open and independent regulator. Changes will require more staff and a greater commitment of time to procedural matters. Above all, they will require an accelerated transformation as well as patience on the part of board members and AECB staff so that the public interest in atomic regulations is not defined in theory or practice in a narrow or purely technical way. Regulatory processes in this area require broader mechanisms for consultation and an independent compliance capability that is both visible and effective.

*See Editor's note, page 41.

Notes

1. For a brief non-technical introduction to CANDU, see *Nuclear Power in Canada, Questions and Answers* (Canadian Nuclear Association, Toronto, 1975) at 1-7 and Wade Rowland, *Fueling Canada's Future*, (Toronto: Macmillan of Canada, 1974), chapter 4.

2. See Michael J. Trebilcock, "Winners and Losers in the Modern Regulatory State: Must the Consumer Always Lose?", a paper presented to the Institute of Public Administration of Canada's National Conference, Ottawa, September, 1975; G. Bruce Doern and V. S. Wilson, *Issues in Canadian Public Policy*, (Toronto: Macmillan, 1974), chapter 1; and, James Q. Wilson, "The Dead Hand of Regulation" (1971) 25, The Public Interest at 39-58.

3. See G. Bruce Doern, Ian A. Hunter, D. Swartz and V. S. Wilson, "The Structure and Behaviour of Canadian Regulatory Boards and Commissions: Multi-disciplinary Perspectives", (1975) 18, Canadian Public Administration, at 189-215.

4. See the Atomic Energy Control Act, R.S.C. 1970, c. A-19. Many of the related laws concern the transport of radio-active substances: interview with AECB's legal advisor.

5. See R.S.C. 1970, c. A-19, s. 9.

6. The constitutional validity of the Atomic Energy Control Act was confirmed in *Pronto Uranium Mines Ltd. v. Ontario Labour Relations Board et al* [1956] O.R. 862. See also *Denison Mines Ltd. v. Attorney-General of Canada*, (1972) 32 D.L.R. (3d) 419.

7. P.C. 1974-1195 (May 30, 1974).

8. *Id.*

9. R.S.C. 1970, c. A-19, s. 8.

10. *Supra* note 7, s. 27.

11. *Id.*

12. *Id.*

13. See Harold P. Green, "Nuclear Power Licensing and Regulation", [1972] Annals of the American Academy of Political and Social Science, 116-126. Dorothy Nelkin, *Nuclear Power and Its Critics*, (Ithaca, N.Y.: Cornell University Press, 1971). For an industry view see Carl Goldstein, "The U. S. Nuclear Experience", a paper presented to Canadian Nuclear Association Seminar, "Public Concern and Nuclear Energy", in Toronto, on September 22-23, 1975.

14. According to interviews with AECB staff.

15. The Railway Transport Committee of the Canadian Transport Commission, the Marine Safety Branch and Flight Standards and Regulations Division of the Ministry of Transport, and the Canada Post Office, respectively.

16. Statement by The Honourable Donald S. Macdonald, Minister of Energy, Mines and Resources on Canada's Uranium Policy, September 5, 1974.

17. As the Minister pointed out in his later statement on safeguards. See s. 7 of the Atomic Energy Control Act, R.S.C. 1970, c. A-19.

18. Office of the Prime Minister Press Release, "Notes for Remarks by the Prime Minister to the Annual Meeting of the Canadian Nuclear Association", Ottawa, June 17, 1975 at 11.

19. See, for example, Advisory Committee on the Biological Effects of Ionizing Radiations, *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation* (National Academy of Sciences, National Research Council, Washington, D.C., 1972); The Bulletin of the Atomic Scientists, vol. XXX, no. 8 (October 1974), at 5-40; Mason Willrich and Theodore B. Taylor, *Nuclear Thefts: Risks and Safeguards*, (Cambridge, Mass.: Ballinger, 1974); G. C. Butler, "Health Hazards from Nuclear Sources", *Symposium on Energy Resources*, Royal Society of Canada, January, 1974; *Nuclear Power and the Environment*, (International Atomic Energy Agency, Vienna, 1973); A. S. Kubo and D. J. Rose, "Disposal of Nuclear Wastes (1973) 182, Science 1205-1208; "Signing of Nuclear Cooperation Agreements", (Statements by Liberal, Progressive Conservative and NDP spokesmen), House of Commons Debates, (January 30, 1976) at 10489-10496; International Atomic Energy Agency Bulletin, Treaty on the Non-proliferation of Nuclear Weapons; Review Conference (May, 1975), Atomic Energy Control Board, "Radioactive Waste Locations in Canada", (Ottawa, February 19, 1976).

20. W. Hafele, "Hypotheticality and the New Challenge: The Path Finder Role of Nuclear Energy", (1974) 12, Minerva at 314-315.

21. Atomic Energy Control Act, R.S.C. 1970, c. A-19, s. 4.

22. *Id.*, s. 4(2).

23. *Id.*, s. 4(1).

24. *Id.*, s. 4(4).

25. The typical meeting in recent years dealt with about twenty agenda items.

26. By s. 7 of the Atomic Energy Control Act.

27. Non-Proliferation Treaty and International Atomic Energy Agency.

28. Atomic Energy Control Board, Annual Report, 1973-74.

29. See Appendix, part C.

30. See W. Eggleston, Canada's Nuclear Story, (Toronto).

31. Atomic Energy Control Board, "Progress Report on Radioactive Waste Investigation in Port Hope, Ontario", Ottawa, February 19, 1976.

32. As the *Point Lepreau Case* indicates. See Appendix, part A.

33. Environmental Assessment Act, S. O. 1975, c. 69. Not yet proclaimed for other than governmental undertakings.

34. A Royal Commission that has adopted special procedures and finding mechanisms to ensure it does not ignore individual and public interest group views.

35. Canadian Nuclear Association, "Nuclear Energy and the Manufacturing Industries", Volume 6 of Conference Papers, 15th Annual International Conference, Ottawa, June 15-18, 1975.

36. See C. A. Dagenais' "Introductory Remarks" to Canadian Nuclear Association Seminar, "Public Concern and Nuclear Energy" in Toronto, September 22, 1975.

37. Office of the Minister of State for Science and Technology, Press Release, "New Contracting Out Policy", August, 1972.

38. See for example, *CCRN Newsletter*, (Montreal, August, 1975).

39. Particulary the *Lepreau* and *Uranium Mining Cases*.

40. See International Atomic Energy Agency, Information Circular, "The Text of the Agreement Between Canada and the Agency for the Application of Safeguards", (Vienna, June 2, 1972).

41. Atomic Energy Control Board, Information Bulletin 75-1 "AECB Staff Reorganization", November 4, 1975, at 1-2.

42. See note 2, *supra*.

43. Hafele, *supra* note 29, at 303-325.

44. See J. H. F. Jennekens, "The Role of Advisory Committees in the Licensing of Nuclear Facilities in Canada", a paper presented to the IAEA Study Group, Athens, Greece, December 1974.

45. As documented in the Appendix attached to this study.

APPENDIX

Case Studies of AECB Licensing and Regulation-Making Processes

Introduction

This appendix contains three case studies of AECB licensing and regulation-making processes. The cases selected serve to *illustrate* the processes used by the AECB, supporting and complementing the analysis in the main body of this study. The first, the *Lepreau Case* involved the licensing of a major nuclear power plant. The two minor studies, more briefly described, also illustrate important issues. The *Uranium Mining Safety Case* deals with regulation-making in occupational health safety. The *Nuclear Powered Pace Maker Case* examines the AECB's regulatory response to a somewhat marginal but nonetheless important technological development.

Each case study contains a brief description of background issues and events, then considers the processes and procedures used by the AECB in the light of the general standards of openness and independence emphasized earlier.

(A) The Lepreau Nuclear Power Plant Case

This case study illustrates the reactor licensing process employed by the Atomic Energy Control Board. It assesses the work of the Board, its liaison with other departments and agencies and its interaction with the public.

The development of the Point Lepreau generating station in New Brunswick provided an interesting focal point for the study because it marked several milestones. It is New Brunswick's first nuclear development. It provided a testing ground for Environment Canada's environmental impact assessment process. And third, the Atomic Energy Control Board experienced its first encounter with a vocal anti-nuclear lobby of citizens demanding that the Board refuse a construction licence until the public had stated its case.

Under the *Atomic Energy Control Act*, a nuclear reactor is designated as prescribed equipment, which means that its use requires a licence. The formal licensing role of the Board is divided into two stages: first, construction approval; and second, approval to commence operation. Preceding the first stage is the preliminary process of site approval. Although the Board does not regard this as part of the licensing process, it was included in this case study because of its relevance to the Board's liaison with other agencies and the public. Table II outlines the stages in the case.

The Board has taken the view that the nuclear industry must accept the major responsibility for implementing safety requirements. The Board requires its licensees to comply with the requirements of appropriate provincial authorities. As the Board's mandate embraces health and safety of radiological materials, it leaves socio-economic and environmental (non-radiological) concerns to be dealt with by the appropriate federal and provincial agencies. The effectiveness of the interaction of these federal and provincial agencies with the Board's schedule is, therefore, important in assessing the adequacy of the Board's role.

(i) *Informal Preliminary Site Evaluation Process*

The Annual Reports of the New Brunswick Electric Power Commission (NBEPC) allude to nuclear power in 1961, and from 1971 through to 1973 exhibit continuing interest in the development of nuclear power. As New Brunswick is dependent on imported oil to meet its increasing energy needs, the desire to secure reliability of energy sources strengthened when oil prices rose in 1973. The search for a reliable alternate source of energy ended when nuclear power was chosen. Why nuclear?

TABLE II

Major Stages and Events in the Lepreau Case

The Actors:	NBEPC:	New Brunswick Electric Power Commission	
	RSAC:	Reactor Safety Advisory Committee	
	AECB:	Atomic Energy Control Board	
	EMR:	Federal Department of Energy, Mines and Resources	
	DREE:	Federal Department of Regional Economic Expansion	
	DOE:	Federal Department of Environment	
	NBDFE:	New Brunswick Department of Fisheries and Environment	
	EAP:	Environmental Assessment Panel	
Informal Preliminary Site Approval Process	1. Permission Sought by NBEPC to submit letter of intent		Nov. 15/73
	2. Official Notice of Intent		Feb. 5/74
	3. Establishment of RSAC		Feb. /74
	4. Preliminary Site Evaluation — Reports Submitted by NBEPC —Reports Evaluated by RSAC & AECB		April 29/74 May-June/74
	5. Interaction with other Federal Agencies (EMR, DREE, AECL, DOE)		June/1974
	6. Granting of Conditional Site Approval		June/1974
	7. Final Site Evaluation Report Submitted by NBEPC		June 14/74
Site Approval Process	8. Public announcement by NBEPC of Site Selection and of Application for Site Approval. AECB public announcement that application had been received.		July 18/74
	9. Interval Before Site Approval a) Further Technical Review by AECB & RSAC b) Organization of Public Information and Meetings Program by NBEPC		July, Aug/74

	10. Announcement by EMR of Federal Loan of 50% of Cost of First New Brunswick Reactor	Oct. 9/74
	11. Announcement by Premier Hatfield of federal approval of New Brunswick Program and Site	Oct. 9/74
	12. AECB Announcement of Site Approval for Point Lepreau Generating Station	Oct. 18/74
Construction Approval	13. From Site Approval to Construction Approval (AECB & RSAC) a) Submission of Safety Report i) design description ii) safety analysis	
	b) Manpower Requirements Report Submitted	Jan./75
	c) Waste Management and Quality Assurance	Feb./75
	14. Joint Environmental Assessment Guidelines Sent by DOE and NBDFE	Dec. 17/75
	15. Joint Announcement of Public Meeting on Environmental Effects of Point Lepreau Station. Written and Oral Briefs Invited	March 14/75
	16. Premier Hatfield announces that Lepreau project would proceed despite Environmental Hearings	March 17/75
	17. Public Meeting Held before EAP (32 briefs presented)	April 3/75
	18. Appeals to Federal Agencies by Citizen Groups	April/75
	19. Environmental Assessment Panel Conditional Approval	late April/75
	20. Announcement by AECB of Construction Licence Approval	May 2/75
Operating Approval Process	21. Operating Approval	(processes under way)

During 1972, Premier Hatfield began discussions with Atomic Energy of Canada Limited (AECL) and the federal Department of Energy, Mines and Resources (EMR) concerning the development of nuclear power in New Brunswick. The discussions, it would appear, contemplated exporting power to northeastern United States to recoup the enormous cost of any plant. The economies of scale of an even larger unit prompted negotiation with other provinces and the State of Maine.

The Atomic Energy Control Board (AECB) was aware of the discussion and that its fruition depended on obtaining financial backing. The obvious source was the federal government.

That some action was contemplated is evidenced by the contract with MacLaren Associates, environmental consultants, who were commissioned to undertake environmental studies of four possible New Brunswick sites for nuclear plants in October, 1973.

(ii) *Informal Intent*

The AECB had received a letter on November 15, 1973 from the NBEPC requesting the Board to permit them to submit a letter of intent before a site had been selected. The Board agreed to this, indicating to NBEPC that it would be interested in commencing informal discussions at the earliest possible planning stage.

On January 23, 1974, at a Ministerial energy conference, the federal government announced it would lend up to fifty per cent of the cost of a provincial government's first nuclear facility. If financial concerns were paramount, this eliminated any further debate in New Brunswick. The alternate source of energy would be nuclear.

(iii) *Official Notice of Intent*

On February 5, 1974 the AECB received an official letter of intent from NBEPC indicating its plans to construct and operate a nuclear power generating station. Proposed was a two-unit 600 megawatt CANDU reactor, planning beginning in April 1974, construction in April, 1975, first fuel loading and start of operation in 1980 with commercial production beginning by the end of the same year.

(iv) *Establishment of Reactor Safety Advisory Committee*

The first task of the AECB after receipt of this notice was to establish a Reactor Safety Advisory Committee (RSAC) to advise on the health and safety aspects of the proposed New Brunswick development. This committee was composed of competent senior engineers and scientists

together with technical representatives of concerned federal and provincial departments and local health authorities. These representatives varied depending upon the location of the alternative sites. No reactor had been licensed by the Board without first being favorably reviewed by such a committee. The extent of the detail of the committee's review has appeared to depend, of course, on the novelty, complexity and size of a given project.

In February, 1974, AECB asked New Brunswick's Department of Health, Department of Labour and Department of Environment and Fisheries for nominees to an RSAC that would assess NBEPC reports.

(v) *Preliminary Site Evaluation Reports*

Reports on two sites (Point Caplin on the province's north shore and Point Lepreau on the south shore) were submitted to the AECB on April 29 by its nuclear and environmental consultants (Dilworth, Meagher, and MacLaren). These reports were reviewed by Board staff over a three-week period commencing May 24. The review included a meeting on June 6 with NBEPC officials and their consultants.

Discussed were various topics arising from the reports but notably site characteristics, technical matters, environmental impact and personnel. Population distribution, land acquisition and necessity of expropriation were considered together with questions of solid waste management, on-site or off-site storage and general questions of flood, ice damage, geology and seismology.

Sea water had not previously been used as a coolant for a CANDU-type reactor. The meeting concluded that the safety implications involved would need special study. Other topics raised included shipping, air traffic, turbine generator accidents and off-site power supplies. The preliminary reports drew no conclusions on the probable impact on the fishing industry and this aspect was discussed. NBEPC agreed to comply with all federal and provincial requests for environmental studies. The Commission noted that discussions with environmental agencies had, to date, not revealed any major environmental objections to the proposed development.

Staffing plans were discussed. NBEPC agreed to submit a recruitment plan to AECB so that the adequacy and quality of staff projections could be assessed.

The meeting showed that further data was needed. And so, CANATOM would study the safety implications of using sea water. AECB and AECL both agreed to investigate further the seismology of the

Point Lepreau area and identify specific design features the site would require. AECB indicated that the final site evaluation report would have to be submitted a month before an RSAC meeting for it to be considered.

(vi) *Interaction with Other Agencies*

The Board met with other federal agencies to discuss site approval procedures and to clarify the role that each would play. On June 20, the AECB brought together representatives from NBEPC, EMR, DREE, DOE and AECL. The agenda included the role and outline of procedures of each agency and department in site approval, a review of the information necessary and available to facilitate site approval, interaction with the provinces, possible areas of co-operation and a likely timetable for licensing.

1. Loan Conditions

This meeting examined the terms of the federal government loans (through AECL) to cover up to fifty percent of the total cost of the project. Most pertinent of the conditions for the loan was the site approval not only by AECB but also by DREE and DOE.

2. The Utility—NBEPC

Before receiving any financing, NBEPC had to submit to the federal government an economic evaluation of the proposal, an assessment of financial risks, a summary of cost estimates and available commercial financing, an assurance that Canadian engineering and components would be given preference, and finally an outline of the project's financial control of the organization. On receipt of these items, the federal government was to estimate a ceiling limit.

The federal government was also prepared to extend similar financial assistance to what would in essence be a regional unit for the maritime provinces. But then, New Brunswick would have to provide an agreement indicating at least an intention to participate by the other provinces, as well as regional evaluation of alternate sources of energy, and the benefits of ensuring a secure supply of energy.

3. Environment Canada — DOE

Environment Canada's role centred on Dr. R. Logie, Chairman of the Environment Assessment Panel. An environmental impact assessment process had been approved by the Cabinet in December, 1973, but actual procedures were not well established. Indeed, the New Brunswick project would be the first opportunity to test the process. Derived from a Cabinet policy, DOE's impact assessment process lacked any legislative basis. DOE

viewed the subject of its assessment to be non-radiological health hazards. Radiological aspects of design were AECB's responsibility. To be coordinated with DOE's process were NBDFE's informal requirements for assessing the environmental impact of the proposed reactor.

4. Energy, Mines and Resources — EMR

Since its Minister was responsible for AECB and AECL, this department's role was quite logically that of coordinator. It seemed more straightforward to co-ordinate through a department rather than a crown corporation. EMR also undertook to be the proponent department for DOE's environmental impact assessment, simply because the process was directed at departments rather than crown corporations. In this case, assessment was mandatory because federal funds were involved.

5. Department of Regional and Economic Expansion — DREE

DREE's interest in site selection arose because of its responsibility for economic development in depressed areas. The northern site appeared more attractive to it for socio-economic reasons. Nova Scotia and Prince Edward Island, however, seemed to prefer a southern site because of its proximity. A northern site was considered to be more costly by $15 to $20 million and entailed additional risks and construction problems because of the ice in the northern waters. Once a site was chosen, of course, DREE's interest would end. The mandates, on the other hand, of AECB and DOE currently involve them formally only after site selection. In fact, informal involvement at all stages at least by AECB, was the pattern.

6. Atomic Energy Control Board — AECB

Of all involved departments and agencies, the AECB procedures were longest established. On receipt of the site evaluation report, AECB scheduled an RSAC meeting for a month later. If there were no major areas of concern, AECB expected to issue conditional site approval five to six weeks after that date.

After granting conditional site approval, the Board required a two to three month waiting-period before full approval. This period was to give NBEPC time to conduct a public information program. As the environmental impact assessment would not relate to radiological effects the Board did not feel that their approval would be conditional upon a satisfactory environmental impact assessment.

7. Provincial Departments

In addition to the federal departments and agencies involved in the process, several provincial bodies were also involved. Reference has

already been made to NBDFE's environmental requirements. Other provincial departments with an interest in the process included NB's Department of Labour, involved not only in nominating a representative to RSAC, but also in making arrangements with AECB to establish jurisdiction under the provincial Boilers and Pressure Vessels Act. The Department of Health in New Brunswick was also involved through its representative on RSAC.

(vii) *Submission of Final Site Evaluation Report*

The RSAC appointed by the AECB met in Ottawa on July 16 and 17 to review the final site evaluation report that had been submitted on June 14. This report, however, dealt only with the Point Lepreau site, since it had been preferred by New Brunswick's Cabinet. The decision had obviously been made early in June to allow NBEPC to submit the report to the AECB Board a month before a scheduled RSAC meeting. However, NBEPC did not publicly announce the site selection until July 18 (this announcement was made ten days after the 1974 federal election). Although AECB had received the site evaluation report a month before this announcement, it could not issue its press release until NBEPC or rather the New Brunswick government chose to make its official announcement.

If the Point Lepreau site had in fact been selected early in June, the meeting later in June with DREE would have been futile, as DREE's only interest was in site selection. It would appear that its role had already been pre-empted by the New Brunswick decision. DREE's influence was felt later when the federal government agreed to finance only one rather than two units on the southern site.

(viii) *The Interval Before Site Approval: The AECB, the Public and the Press*

The public announcement by the New Brunswick utility that it intended to construct a nuclear station at Point Lepreau was made only after the Board had signified that it could see no major obstacles at this stage in the licensing process.

The period between the announcement and the Board's grant of site approval had two purposes. The first purpose was to enable the Board's staff and committees to continue technical review and to negotiate and resolve any difficulties with the utility. The RSAC's review of technical matters continued, assisted by the Board's staff.

The Committee was scheduled to meet during this period for about two days every six weeks to discuss the report and its requirements. The matters covered in the site evaluation report related to plant size, reactor type, the

proposed containment method together with general information concerning the site, such as topography, geological and meteorological data, data on water quality and other aspects of the physical environment.

To meet regulatory requirements, NBEPC issued a press release on July 18 stating that application for site approval had been made. The Board also issued a press release to the effect that it had received such an application. As previous discussions indicate, several months of negotiation and discussion had preceded the formal application for site approval. Was the press release on July 18 the first indication to the public that the province would go nuclear?

On January 8, 1974, the *Daily Gleaner* in Fredericton had carried a report of an address to the annual general meeting of the Fredericton Chamber of Commerce by the General Manager of NBEPC. It quoted him as saying that the Power Commission was studying the possibility of nuclear power for the province. The realization of this plan would be contingent upon Ottawa's financial support. The same newspaper on March 26 carried a small report that New Brunswick had taken steps to buy nuclear equipment totalling $27 million. Careful readers of this newspaper must at this stage have been aware that nuclear power was more than a distant hope or fear.

On April 8, the *Daily Gleaner* reported that the Chaleur Environmental Protection Association had been formed on Sunday, April 7, by representatives of the Northeastern Regional Development Council, the Eel River Bar, the Mic Mac Band Council, the Jacquet Environmental Council, Pollution Probe (Moncton) and the South Shore Environmental Protection Association of Nova Scotia. Spokesman Dorothy Revenscroft said the main object of the group was to oppose the development of nuclear energy.

The following day the Halifax *Mail Star* also carried a report of the formation of the New Brunswick group. An article entitled "Atomic Power Critics Mislead - Action Needed" reported that the group opposed the building of a nuclear plant not only in the northeastern section of New Brunswick but elsewhere in the province as well.

In May, the Chaleur group actively corresponded with editors of local papers. On May 8, the Campbellton *Tribune* carried an open letter from the group to the Mayor of Dalhousie, New Brunswick. On May 25, the *Telegraph Journal* of St. John, New Brunswick, published a letter the group had sent to Jack Davis, then Minister for the Environment. This letter pointed out that on March 14 in the House of Commons, the Minister had stated that where a project was of sufficient public concern, a non-government review board would be appointed to conduct an environmental impact assessment. This group demanded that such a board be created to review the nuclear reactor decision in New Brunswick.

The next major report appeared on July 19 in the *Globe and Mail*. It affirmed that the Bay of Fundy site had been chosen but no decision had yet been made for a second unit which required the participation of Nova Scotia and Prince Edward Island. The report noted that the Premier of New Brunswick had announced that Point Lepreau was one of twenty sites originally considered, that had been narrowed down to three for the final selection. The other two sites were on Chaleur Bay in the north. Development costs at Point Lepreau were estimated to be $30 million less than either northern site. However, a northern site would be purchased for a second development in the 1980's. The advantages of Point Lepreau included federal ownership of most of the required land and existence of only four dwellings on the selected site.

The *Globe* report went on to mention that public meetings were planned for August to provide information to the public and an opportunity for public comment and questions. Concern focused on the commercial fishing in the Bay of Fundy because the plant would apparently discharge 250,000 gallons of water per minute 18 to 24 degrees warmer than the Bay temperatures. On the positive side, it appeared that the project would provide employment for 2,000 people during construction, eventually needing a permanent staff of 265.

The AECB had at this point already received a number of communications from concerned citizens representing various anti-nuclear lobbies. One such enquiry from the Voice of Women expressed deep concern over projected plans for a nuclear plant in New Brunswick and asked for information on federal nuclear development policy. Similar enquiries came from an environmental group called Green Leaf in Dalhousie, New Brunswick, calling for a stop to the introduction of nuclear power in New Brunswick and from the Chaleur Environmental Protection Association. Several Members of Parliament also contacted the Board to ask about the nuclear power program for New Brunswick.

Some sections of the public were clearly aware that something was happening concerning nuclear power. New Brunswick M.P.s, personally motivated or prompted by citizen groups, began to express some concern over the introduction of nuclear energy in their province and the method of decision used by those responsible for taking the province into the nuclear realm. That individuals and groups chose to come directly to the AECB perhaps indicates that satisfactory answers were not available from NBEPC.

Interestingly, the Power Commission's public information program for nuclear power began in 1972. In the environmental impact statement it released in March 1975, NBEPC listed milestone dates, events and activities

for the Point Lepreau Nuclear Generating Station. During 1972 and 1973, the New Brunswick Electric Power Commission stated it had held preliminary internal meetings on power requirements and alternative means of supply, made presentations to 39 New Brunswick high schools, a New Brunswick teachers' seminar, to NBEPC staff at branches and generating stations, to New Brunswick service clubs and organizations, as well as providing information through a Summer Fair program in key New Brunswick centres.

During 1974, the following events set the stage for the licensing process:

a) Premier Hatfield announced his energy policy following the first Ministers' Conference on January 29, 1974;

b) A letter of intent was sent by NBEPC to AECB on February 5, 1974;

c) Lieutenant-Governor Robichaud made the official announcement of the project on March 6, 1974;

d) Site evaluation reports prepared by NBEPC and AECL were sent to AECB on June 14, 1974;

e) NBEPC met with RSAC on July 16 and 17, 1974;

f) Premier Hatfield held a press conference outlining the energy program on July 18, 1974;

g) MacLaren's environmental studies were released on July 18, 1974.

Following the announcement by NBEPC of its site selection and its application to the AECB for site approval, the utility held public information meetings as required by the AECB. Nine meetings were held during July and August of 1974. The issues raised at these meetings ranged from the need for the power plant, and its environmental effect to the processes used to reach public decisions. Most of the issues were to be raised again, even more emphatically, at the public meeting held in April, 1975, by federal and provincial environment authorities. Although the July and August, 1974, meetings were held by NBEPC, AECB representatives attended and so did New Brunswick environment officials.

The greatest concern expressed at the 1974 meeting was about the effect of the plant on marine life. NBEPC officials responded by explaining that environmental impact studies had been conducted and more studies would be available within a year. Many participants were upset that these meetings were the first time that the Power Commission had asked for public comments. On the other hand, at a meeting sponsored by the St. John Board of Trade and the St. John District Labour Council to which municipal and provincial officials were invited, general approval for the project was voiced.

Other recurrent themes expressed at the 1974 NBEPC public meetings concerned the storage of spent fuel, the consequences of an airplane strike on the spent fuel bay, the seismic activity in Point Lepreau and its suitability as a site, and whether any electrical output would be exported to the United States. In reply, NBEPC officials assured those attending that short-term storage in water-filled bays with future reclamation of the plutonium content was possible, that geologists and experts in seismology considered regional faults in the area to be stable and that exports were not contemplated. In summarizing its public information program, NBEPC suggested to AECB that it had not unearthed problems or considerations that were not previously known. The utility stressed the concern that the power station be constructed and operated for the maximum advantage of the residents of the community in which it would be located. The major thrust of public concern, according to NBEPC, was that the plant should not damage the Bay of Fundy fishery.

The interval between the announcement of the site selected and the Board's approval of the site was intended to be six to eight weeks. This, it was thought, would give enough time for the public information program and enable the Board to assess the documents submitted to it and carry out its own technical review.

The NBEPC was naturally anxious to proceed with the project. It pointed out to the AECB the urgency of an early beginning for preliminary construction work at the proposed Point Lepreau site. It urged an early decision.

To its credit, AECB was unmoved by the economic considerations pressed by NBEPC. The Board's role was clear: to assess radiological health and safety aspects of the proposed nuclear power station. Consequently, it would not short-circuit any of its licensing procedures.

(ix) *Financing and Site Approval*

On October 19, 1974, a press release was issued by EMR publicising the Minister's announcement of the federal government's agreement to provide loans for up to fifty percent of the cost of a 600 megawatt CANDU nuclear unit to be built at Point Lepreau in New Brunswick. This was in line with the federal policy announced in January of the same year for the first nuclear reactor to be built in a province. The release stated that AECB would grant site approval in a few days. DOE had carried out a preliminary assessment at Point Lepreau and was satisfied that the site was generally suitable. Final approval, however, would require completion of an environmental impact statement. Consultants to NBEPC were working on the necessary studies for this statement.

The press release sounded the death knell for the larger 1200 megawatt CANDU originally envisaged for Point Lepreau. Arguments on economies of scale advanced three years earlier had apparently lost their foundation.

The influence of DREE may be apparent here. The press release indicated that extensive discussions would continue on federal support for a second nuclear unit that could encourage economic expansion in the northeast and involve joint participation with neighbouring provinces.

On October 9, Premier Hatfield had already announced federal approval of the New Brunswick program and site. As stated:

> This is an historic day for all the people of New Brunswick. Today's announcement marks a great step forward towards the achievement of our economic goals. Approval by AECB and various federal ministries means we can get on with the program. We are the first of the smaller provinces to enter the nuclear age — only Ontario and Quebec have done so before us...To proceed with this program New Brunswick had first to prove the soundness of our financial and economic prospects and, second, demonstrate our ability to manage a technology which is still exceptionally advanced. That New Brunswick met these two challenges so successfully is the true historic significance of today's announcement and gives us more reason for pride and confidence in the future of our province.

(x) *The Construction Approval Process*

AECB's announcement on October 18, 1974, that it had granted site approval for the Point Lepreau Generating Station marked the close of the first stage of the licensing process and the beginning of the second stage. This involved the issue of a construction licence and required a meticulous review and assessment by AECB of technical data submitted by the proponent. The main document required by the Board was called the Safety Report.

1. The Safety Report

The first part of this report was to describe the design of the reactor and summarize all important process and safety features. The station at Point Lepreau was to follow a ''standardized'' design, similar to Hydro Quebec's reactor, Gentilly II. However, since the Point Lepreau site was planned eventually as a two unit operation, the one unit Gentilly II design for site layout and building design required some modification.

Point Lepreau was also the first coastal CANDU 600-megawatt reactor. This necessitated intensive study of condenser tube materials for salt water application and careful consideration of secondary site feed-train material selection and feedwater chemistry.

AECL commissioned CANATOM Limited to review the operating experience with salt water cooled condensers. A very thorough study was carried out and described in a report entitled "Salt Water Cooled Steam Surface Condensers - Design Parameters and Material Selection, CANATOM Proprietary Report, December, 1974".

The second part of the safety report comprised a safety analysis evaluating the consequences of failures in the process system. Information on the reactor site was also required and this included details on land use, population, principal sources and movements of water, water usage, meteorology and geology. The information submitted to the Board was reviewed by its staff, RSAC reactor safety committee and the Board's special materials and Equipment Control Directorate. The highly technical nature of this material and the detailed assessment and review of it requires a considerable amount of time both for the applicant as compiler and the AECB, as reviewer.

2. Manpower Requirements

Among the documents submitted to AECB Board by NBEPC was a report on manpower requirements based on advice from Ontario Hydro. This report was received on January 17, 1975, reviewed by AECB staff and found to be generally reasonable. On March 20, 1975, a copy of AECB's comments was sent to NBEPC for consolidation with its other data.

3. Waste Management and Quality Assurance

Following a meeting with AECB in February, 1975, NBEPC forwarded a waste management site report compiled by its consultants. This was reviewed in March by AECB's Materials and Equipment Control Directorate. Concurrently, AECB staff examined NBEPC's quality assurance program. An internal memorandum suggested that shortcomings in the quality assurance program would be sufficient cause for AECB to consider withholding a construction permit. But these shortcomings were subsequently overcome to the Board's satisfaction.

4. Reactor Safety Advisory Committee

RSAC was kept busy during this stage. Members of the committee were sent NBEPC's initial report in early February, 1975. The report was substantial. One committee member indicated he spent nine working days examining the report and submitted fourteen pages of questions to AECB staff. These were referred to NBEPC who, in conjunction with AECL, endeavoured to answer them. This was not completed until June, 1975, after the construction permit had been granted. Despite this experience of one committee member, AECB was clearly very heavily involved itself in clarifying shortcomings in NBEPC's reports.

(xi) *Environmental Impact Assessment Process*

AECB, of course, was not the only regulatory authority concerned with the Point Lepreau plant at this stage. After site approval had been granted, the role of DOE came into focus. DOE, together with NBDFE, the New Brunswick department responsible for environmental matters, issued joint guidelines for the preparation of an environmental impact assessment by NBEPC on December 17, 1974.

A press release dated March 14, 1975, announced that a public meeting was to be held on the environmental effects of Point Lepreau Nuclear Generating Station. This announcement was made jointly by Jeanne Sauvé, Environment Canada Minister and New Brunwick Environment Minister Fernand G. Dubé. Comments from the public were invited on a report describing predicted environmental effects of the proposed nuclear generating station at Point Lepreau. The meeting was scheduled for April 3, in St. John. Briefs and oral presentations were invited. The meeting was to be chaired by Brian Barnes, Assistant Deputy Minister of Environment for New Brunswick and Dr. R. R. Logie, Chairman of the Federal Environment Assessment Panel.

This public meeting was the first to be held under the new federal environment assessment and review process. The process, instituted in April 1974, requires that all federal government projects be screened in the early planning stages to make sure that they do the least possible damage to the environment. These include projects involving federal funds or crown lands. At Point Lepreau, federal funds (in the form of a loan) and federal crown lands (those comprising the major part of the Point Lepreau site) were involved.

As the press release stated: "The assessment process, in cases of wide public interest, calls for the establishment of a review panel to receive public comments. It is under this provision that a review panel has been formed and a public meeting is being held." The release went on to mention that NBEPC had placed copies of the MacLaren report in public libraries in Edmunston, Woodstock, Campbellton, Dalhousie, Bathurst, Newcastle, Chatham, Moncton, Sussex, St. John, St. George, St. Andrews, St. Stephen, Deer Island, Campobello, Grand Manan, Northhead and Fredericton.

The announcement of this public meeting heartened those members of the public who had found the earlier meetings held in July and August by the NBEPC to be of little value as a medium for public debate. These people regarded the environmental meeting as the first opportunity for a full-scale public debate on the Point Lepreau site. Their hopes were quickly dashed, however, when Premier Hatfield announced in a television interview on

March 17 that despite the environmental meeting, the Point Lepreau project would go ahead. Nevertheless, opponents of the Point Lepreau project turned up in force at the meeting on April 3, 1975. Those who presented briefs opposing the development of the site outnumbered those who favoured it by four to one.

1. The Public Meeting

Presiding at the meeting in St. John on April 3 were the two Chairmen and a panel including F. C. Boyd (EMR), Dr. P. Ruggles (DOE), Dr. H. M. Hill (DOE), Mr. D. R. Silliphant (NBDFE) and Mr. O. Washburn (NBDFE). The AECB was represented by Dr. Prince, the President, and Mr. Jennekens, Director of the Licensing Directorate. The AECB representatives did not join the panel but remained as observers in the audience. This seemed adequate as the meeting gave no opportunity for panel members to respond to questions. In fact, there seemed little purpose in having a panel at all.

The meeting lasted for three and a half hours in the afternoon and after a dinner break continued five and a half hours more. Thirty-two briefs were presented to the panel by individuals and representatives of various interest groups in New Brunswick and Nova Scotia. In view of the limited time available and the large number of briefs, it was agreed that there would be no discussion of the briefs and no questions would be answered at the meeting. It was further agreed that questions asked would be consolidated and written replies sent to those making presentations.

It was evident that several groups, both supporters and opponents of Lepreau, had expended considerable effort in the review of the preliminary environmental impact report prepared by MacLaren. Several of the briefs were well researched and written in a manner that prompted the interest and support of those attending the meeting.

2. Peripheral Issues Raised at the Meeting

Many of the statements and questions in the briefs submitted were clearly outside the *stated* scope of the environmental assessment and review. These matters included:

a) criticism of the handling of the public participation and information program conducted by the government of New Brunswick and NBEPC;

b) a request for a judicial-type of hearing on the desirability of the project, to be presided over by a duly appointed judge of the Supreme Court of New Brunswick who would be charged with making a decision as to whether or not the project should proceed on the basis of arguments presented by opposing groups;

c) criticism of the Premier of New Brunswick for his recent statement that the project would proceed regardless of the public meeting on April 3;

d) criticism of the Minister of Environment Canada for mismanagement of the environmental review process that resulted in insufficient time for public response to the consultant's report and for failing to have an environmental impact study in the early stage of the project, rather than after a commitment to it had been made;

e) skepticism about the need for the nuclear power plant now or at any time since additional hydro power is scheduled and the preferred large block of power should be derived from Bay of Fundy tides; and

f) the adequacy of uranium reserves sufficient to ensure fueling of the proposed station throughout its lifetime.

3. Central Issues Raised at the Meeting

The major concerns regarding the report and related matters presented during the meeting appeared to be the following;

a) concern about the radiological effect on flora and fauna, but particularly on the fishery industry in the Bay of Fundy:

b) concern over the problems of irradiated fuel storage and waste management in general. (Continuing concerns expressed throughout the meeting were the dangers posed by radioactive fission products with long half lives, especially the isotopes of plutonium. The fact that plutonium 239 has a radioactive half life of 24,000 years was mentioned by several persons);

c) concern over the consequences of a serious reactor accident. (One person stated that until such time as the Atomic Energy Control Board was able to provide absolute assurance that a serious accident would not occur she would continue to oppose any proposed nuclear power station); and

d) concern about the adequacy of MacLaren's environmental assessment. (Several briefs mentioned that the assessment had been prepared in a short period of time, that base line data on site characteristics had not been collected over a period of a year or more, and that a considerable number of ongoing measurements and surveys would be necessary before a complete assessment could be made).

4. The Conduct of the Meeting

The number of briefs presented made the meeting long, tedious and one-sided. There was no opportunity for debate. The fact that because of the procedures adopted the Chairman and panel members did not respond during

the meeting meant that many erroneous statements went unchallenged. For example, it was asserted that the Atomic Energy Control Regulations allowed members of the public to be exposed to doses of ionizing radiation 100 times greater than that permitted in the United States. Further, several speakers stated that the construction licence from AECB had already been prepared and was to be issued the day after the meeting. That these statements were allowed to go unchallenged perhaps resulted in more harm than good. In this case, the pressures of time did not warrant the restrictions they placed on dialogue.

In commenting on the meeting those members of the Board present suggested that future public information programs and the presentation of briefs to an environmental assessment review panel should be scheduled over a longer period. The question of the need for additional electric generating capacity should be settled well in advance of a decision to proceed with a particular project. The related question of the type of generating station to be built should also be decided on the basis of relative economic, technical and environmental considerations. These questions, in the view of some AECB participants, should be answered before attempting a detailed environmental assessment for a particular project.

The inadequacies of this first environmental assessment meeting were apparent to almost everyone there. Following the meeting of April 3, all departments and agencies involved, both federal and provincial, were subjected to repeated requests from interest groups to intervene, or delay or help end the Lepreau project. The AECB was urged to delay the construction licence until a satisfactory environmental assessment report could be presented. Federal environmental authorities were forced to admit that the project was virtually a *fait accompli*, despite the environmental review process.

(xii) *Construction Licence Preliminaries*

1. Atomic Energy Control Board

By the time the meeting of April 3 had been held, the AECB had already received favourable recommendations from its staff and RSAC on the proposed project. The Board, however, decided that issuing its construction licence should be co-ordinated with the actions of DOE. The AECB decided to await the recommendations of the environmental assessment panel and the communication of answers to the questions raised by those who submitted briefs. It was expected that this would be completed by late April.

2. Environmental Assessment Panel

At this point, federal environment officials had already stated that they were unaware of any insurmountable environmental problems. They indicated that a conditional approval similar to that used by AECB in its construction licences would appear to be appropriate. NBDFC also expected to submit a report to its Minister by mid-April. It should again be noted that the Premier of New Brunswick had already stated that the Point Lepreau project would proceed regardless of environmental findings.

In the meantime, a review of MacLaren's preliminary environmental impact report by DOE officials had concluded that it could not be used as a basis for assessing the environmental impact of Lepreau. It seems fairly clear that in the five weeks following receipt of this report by the environmental assessment panel, pressures outside DOE began to build to allow the project to proceed without further delay. NBEPC was anxious to go ahead with slip forming of the reactor building in October, 1975. Otherwise, winter snow would delay the project schedule for about six months.

By the third week in April, AECB realized that the written replies being prepared by the environmental assessment panel (to be sent to members of the public who had made representations at the meeting of April 3) focussed on nuclear power in general and not on Point Lepreau or AECB's role. Concern in AECB began to increase over the possibility of a delay because of winter that could increase the project's costs in the order of several tens of millions of dollars. The Board seemed certain that the public interest would best be served by issuing the construction licence no later than the end of April. Adequate controls for environmental effects could be incorporated in the Point Lepreau licence as conditions requiring the implementation of the impact assessment.

(xiii) *Issuance of Construction Licence*

On May 2, 1975, AECB announced the issuance of a licence to NBEPC to construct the proposed nuclear plant. In reaching this decision, the Board considered recommendations from RSAC and AECB staff that were based on extensive reviews of information submitted by NBEPC on the design, construction and operation of the proposed station. The site itself had been approved by the Board in October, 1974.

In the words of an AECB press release of May 2, 1975:

> In issuing the construction licence the Board noted the conditions imposed on the licensee as announced by the federal Minister of the Environment, including continuing surveillance of aquatic life in the vicinity of the plant, approval of design of cooling water intake and discharge structures, and a longer term environmental effect monitoring program.

The AECB's announcement followed an announcement by DOE recommending that a construction licence for the plant be issued. DOE, however, conditioned this recommendation, calling on NBEPC to:

a) collect data on the aquatic life in the vicinity of the site using guidelines approved by DOE to see if construction or operation of a nuclear power plant in any way interfered with the marine life;

b) design the cooling water intake and discharge pipes to minimize effects on marine life, using results of the required aquatic surveys. (DOE scientists were particularly concerned about destruction of young fish, specifically salmon, coming into the Bay of Fundy from a nearby river); and

c) set up and operate a continuous monitoring program for radioactive emissions from the power station. (This program was to be designed as much to see if the expected low levels of radioactive emissions had any effect on wildlife as to detect any higher than expected radioactive emissions of potential danger to humans).

With the issuance of the construction licence, the possibility of effective protest ended for those who had so vocally opposed the nuclear power plant. Many questions remained unanswered in the minds of people who had taken the time and effort to review the environmental reports made public. The environmental departments' officials, at both provincial and federal levels, had attempted to inform the public by providing written responses to the public's briefs and submissions. But they had not provided a forum for open debate and questioning. The only body prepared to meet the people appeared to be the AECB.

(xiv) *Postscript: The Board Meets with Environmental Groups*

Early in June, arrangements were made between AECB and the co-ordinator of the Maritime Coalition of Environmental Protection Associations for a meeting on June 25. At an all day meeting between representatives of the coalition and Mr. Jennekens and Mr. Ewing of the Board, the concerns of the group regarding the use of nuclear power as a means of electrical generation and the siting, construction and operation of the Point Lepreau station were discussed.

Much of what was said involved very broad issues involving national energy policy, dissemination of information and organization and operation of the Atomic Energy Control Board. It was obvious that those present were unhappy with the way that the decision to construct the Point Lepreau station was made. They were particularly aggrieved by the difficulties they experienced in obtaining reliable information about the design and operation of nuclear power stations, the methods and results of safety analyses and

health physics matters. Some felt that information provided by AECL or NBEPC was not to be trusted since these entities were promoters of nuclear power and in some instances had supplied factually incorrect information. They also felt that there had been a deliberate attempt to cover up information such as reports on safety and events at operating stations by classifying these as proprietary and consequently privileged.

The Maritime Coalition made two recommendations. First, the AECB or other governmental agencies should provide financial support to help cover the costs of extensive literature surveys, the hiring of consultants to act on behalf of the Coalition and to publicize the Coalition's point of view. Second, a governmental body should be established to disseminate information and discuss relevant concerns with public interest groups.

As for the organization and operation of the AECB, some people at the meeting felt that the Board was too easily seen as associated with the nuclear industry. Its impartiality could as a result be questioned. However, others saw the Board as the only reliable source of information and the only agency that could be trusted. The Coalition, nevertheless, suggested that AECB staff could well be strengthened by including persons able to evaluate non-technical issues such as the sociological impact of nuclear power stations as well as persons drawn from public interest groups who could provide a broader balance of viewpoints and background.

Several suggestions on the AECB's licensing role were also made by the Coalition. Owners or operators of nuclear power stations should be required to disclose publicly all information pertinent to the siting, design and operation of the facility. Furthermore, no funds should be spent until the issuance of a construction licence.

From their comments on the session the AECB officials attending found the meeting allowed a useful exchange of ideas and information to occur. They noted, however, that much of the discussion concerned broad issues that the participants were unable to resolve. It was suggested that any future meetings should be limited to matters directly affecting the health and safety of the public.

AECB believed that additional meetings would be useful to provide more information to the public about the agency's role and activities. In spite of considerable efforts by the Board in answering letters and providing publications, there was clearly still a tendency to identify or confuse the AECB with the nuclear industry, and particularly AECL.

That the AECB officials met with the members of the Coalition was commendable. But by the issues raised at this meeting, one can readily see

that meetings of this nature should have been held much earlier in the planning process. Once the decision had been made by the Government of New Brunswick to go nuclear many of the issues which the public wished to raise became redundant. AECB's role in the process only commenced once the decision to construct a nuclear plant had been made. Consequently, AECB was not, and could not be, in a position to debate the merits of such a decision. Access to debate of this decision was the responsibility of the New Brunswick Government and federal departments, like DOE.

(xv) *Issues Raised by the Case*

The role of the AECB was summarized by Mr. J. L. Gray (Past President of AECL) in an address to the 15th Annual International Conference of the Canadian Nuclear Association in June, 1975, entitled "CANDU Milestones":

> As the atomic energy projects increased in scope and complexity, a Crown corporation, Atomic Energy of Canada, Limited, was established with responsibilities for planning, financing, and management of all such activities and the responsibilities of the AECB were restricted to safety, health and other regulatory matters. The separation of control and regulation, under the AECB, from development and promotion, under the NRC and later AECL, turned out to be a key decision...Not only has the requirement for review at all stages by the AECB insured that the designers, constructors and operators pay particular attention to safety but, in general, the government and the public have been satisfied that the safety and control procedures of the AECB are in fact effective.

This case study indicates that AECB's procedures are in fact directed toward ensuring that health and safety requirements are of paramount concern. AECB considers that its formal role commences after the decision to build a nuclear plant has been taken and a site selected by the provincial authorities. It also takes the view that its health and safety mandate stops at radiological effects. The non-radiological effects are the responsibility of DOE.

Environment Canada also believed that its role commenced after site selection, even though the assessment of alternative sites would seem to be the most logical way of proceeding. The work of DOE's Environment Assessment Panel did not enable the public to participate effectively. AECB continually referred people wanting to debate the nuclear question to the public meeting held by environmental officials. But this meeting occurred at too late a time in the planning process. The decision to build a nuclear plant had been made and the site had been selected. And these were the issues which the public wished to debate. AECB referred people to the Environmental Assessment Panel. The Panel referred people to the Province of New Brunswick. And the public became an unwilling passenger on this federal-provincial merry-go-round.

The AECB, as the Lepreau case illustrates, was informally involved in the pre-site approval process. The site obviously has implications for health and safety. But to ensure early public debate, the AECB could require as a condition of being licensed that a proponent announce publicly its intention to seek site approval and satisfy the AECB that adequate public debate had taken place before the grant of site approval. It could also require in the same way that safety advisory reports are made public.

This would achieve two ends. It would enable debate on general issues to take place at the provincial level at an early stage. Second, it would bring environmental questions to the fore when they should be raised. This is when the public participation component of environmental assessment is most useful.

There could well be a minor but very useful role for the AECB at the early planning stage. As the only independent source of information for highly technical data on nuclear power, AECB has a staff with an expertise that could add objectivity to early proceedings considering the initial decision whether or not to construct a nuclear plant. AECB currently lacks the staff or resources to play such an additional role. It should, nonetheless, contemplate securing of the additional funds necessary to support a broader and more structured involvement in the process of decisions leading to the construction of a nuclear power plant. The demand for greater public involvement in decisions involving nuclear power should be recognized by the AECB in its policies, practices and procedures. These should encourage proponents to obtain the benefits of broader public participation providing timely opportunities for informed debate.

The AECB is instructed to act in the national interest in the control, development and use of nuclear energy. Its task involves health and safety measures. But, the flexibility of this mandate gives the AECB ample scope for structuring its licensing tool to nudge the proponents several steps further. This would benefit not only the public at large but also its perception of the AECB as an effective regulator that acts in the public interest.

(B) The Nuclear-Powered Pacemaker Case

This case study illustrates how the Atomic Energy Control Board responded to the introduction of a new nuclear-based technology, the radio-isotopic powered cardiac pacemaker. The background events and stages of the AECB's response will be briefly described and then a number of issues about the regulatory process will be raised.

(i) *Background Events and Stages*

In July, 1971, AECB received an application from Medtronic of Canada Ltd. to import and distribute over a two-year period thirty Medtronic Laurens-Alcatel Model 9,000 pulse generators, each powered by a radioactive source containing 2.5 curies (150 mg) of Plutonium - 238. These nuclear power cardiac pacemakers had a potentially longer useful life and higher reliability than comparable chemical-battery powered devices. Their use would reduce the frequency of replacement surgery. The original manufacturers and supplies were two French firms.

Risks in using these devices arose from radiation exposure. The person in whom a device was implanted, persons in continual close proximity to that person, and others who might be exposed because of loss or improper disposal of the plutonium fuel capsule, all might be exposed to excessive radiation.

In August, 1971, AECB established an Advisory Committee on licensing of nuclear powered cardiac pacemakers to advise the AECB President on all aspects of licensing. On the committee were AECB staff and representatives of the Radiation Protection Bureau of the Department of National Health and Welfare.

The Advisory Committee met several times and had a number of meetings with the applicant's representatives. In July of 1972, it met with representatives of the United States Atomic Energy Commission (since renamed the Nuclear Regulatory Commission) that had just issued the first U.S. licence for nuclear powered cardiac pacemakers. In addition, individual members of the Committee had participated in meetings on technical and licensing aspects of nuclear powered pacemakers which had been sponsored by the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development (OECD).

In January, 1973, the Committee recommended the following:

1) That the Atomic Energy Control Board authorize Medtronic of Canada Limited to import, possess, and distribute to appropriately licensed hospitals

and/or surgeons not more than fifteen Medtronic Laurens-Alcatel Model 9000 Isotopic Pulse Generators during the period of approximately one year.

2) That these 15 devices be controlled by means of a three-level licensing system (distributor, hospital/surgeon, and bearer).

3) That the limited rate of distribution and the proposed licensing system constitute a trial program which is intended to yield further information and experience.

4) That the recommended licensing action, trial program, and other matters be conducted with close co-operation between the Department of National Health and Welfare and the Atomic Energy Control Board.

5) That an extensive information program be initiated and directed towards groups such as provincial health departments, hospitals, surgeons, coroners, morticians, bearers, and the general public.

6) That discussions be initiated in co-operation with the Department of External Affairs to facilitate unrestricted travel of Canadian radioisotopic pacemaker bearers within the North Amercian continent and subsequently to other continents. As an interim measure, it is recommended that the Board authorize controlled entry into Canada of all persons bearing the Laurens-Alcatel Model 9000 radioisotopic pacemaker.

7) That discussions be initiated toward the promulgation of new or the amendment of existing legislation to provide a "legally-certain" method of recovery from deceased bearers of implanted radioisotopically-powered prosthetic devices.

8) That a national registry of patients who have received radioisotopic pacemakers be kept and that, at least during the trial program, routine follow-ups of these patients should be conducted.

9) That the Committee continue to be active for the purposes of monitoring the trial program, co-ordinating Canadian contact with other national authorities and international organizations, and considering future applications for authorization of different designs of radioisotope powered cardiac pacemakers.

The committee recommended and the AECB later in 1973 adopted a relatively cautious strategy. Rather than the 30 units over a two-year period requested by the applicant, the AECB initially approved only 15 units over a one year period. This strategy was adopted for two reasons: first, to acquire more information and experience with these devices, and second, to encourage the applicant to submit certain outstanding information already requested by the AECB. This information included technical data on the results of cremation, temperature tests, long-term corrosion resistance in accordance with NBA Guidelines, and an improved definition of a quality control program. The AECB, and its American counterpart, had experienced difficulties in getting this information from the applicant and its French suppliers.

AECB's need for more information and experience arose from the agency's desire to assess more fully the risk-benefit characteristics of the

technology that had been identified. The sort of information involved included:

a) Hazard analysis relating to loss of fuel capsule integrity and resultant dispersal of plutonium through crematorium stack release and ground burial release;

b) Indication of actual useful life and reliability of radioisotope-powered device;

c) Control and recovery effectiveness;

d) Use of smaller quantities and less radiotoxic types of radionuclides; and

e) Alternative non-radioisotopic power sources.

Quite understandably, AECB also wanted information and experience from other countries with implant programs. It was also awaiting the final NBA Safety Guidelines that in early 1973 were still in draft form. Another uncertainty was the availability of legislation to assure "legally-certain" recovery of isotopic pacemakers in the event of death.

In 1973, the AECB issued its first licences for nuclear powered pacemakers. By late 1975, approximately 50 nuclear pacemakers had been licensed. No specific regulations were implemented to govern the new technology. Instead, requirements and standards derived from the NEA guidelines were incorporated into every licence.

(ii) *Issues Regarding the Regulatory Process*

A number of instructive issues about the regulatory process emerged from this example of regulatory response. These issues illustrate the dilemmas that an agency, like AECB, faces.

a) Nuclear technology is usually associated in the public's mind with large nuclear power stations. This case study illustrates the regulatory issues at the *micro-technology* level.

The technological initiative came from a private firm wishing to import and market a new product. The product presented immediate problems to the agency. No standards existed for the health and safety of users and others who might come into contact with the product.

Regulating a device like a pacemaker posed serious problems of monitoring and compliance as users travel to other countries, and sometimes die in unpredictable circumstances and places.

The application suggested future regulatory nightmares - such as mass-produced nuclear powered wrist watches. But it also demonstrated the lack of readily available research findings that could be used by the regulatory agency to test the applicant's claims.

Despite the marginal benefit of the technology involved, AECB seemed to feel obliged to grant some form of licence merely because a licence application for a novel technology had been made. Would it be better not to license at all, given the uncertainties, the lack of knowledge about all the risks and benefits, at least until growing experience elsewhere provided guidance?

b) AECB in this case set standards by incorporating them into licences rather than passing regulations. The agency's Advisory Committee met with the applicant but did not publicly seek advice or opinion. The public information program was held mainly after the licensing process. The agency seemed to defer almost exclusively to the technical guidelines developed by NEA and the very modest American experience.

A cautious regulatory strategy is understandable when economic and political forces are large and organized (as in the Lepreau Case). AECB's instinct for the middle ground are less understandable in the nuclear pacemaker application where outside pressures were minimal. The agency did not, admittedly rush to regulate, taking almost two years to consider the matter. It did, however, adopt a middle position without consulting or providing an opportunity for the open expression of Canadian opinion.

(C) The Uranium Mining Safety Case

This case study raises both old and new issues for the AECB. At the time of writing, the agency was actively engaged in reassessing its regulatory processes and standards for uranium mining. The case illustrates some of the serious intergovernmental (especially federal-provincial) difficulties and pressures regarding regulation-making and compliance. Again, a description of the historical and recent background events precedes an analysis of the issues the case raises for regulatory processes and procedures.

(i) *Background Events and Stages*

Most of the key events in the history of uranium mining regulation were summarized in AECB's brief of June 3, 1975 to the Royal Commission on the Health and Safety of Workers in Mines in Ontario. The brief dealt with federal-provincial arrangements, the inclusion of radiological protection provisions in the Atomic Energy Control Regulations, the management of health and safety in mines, and the establishment in June, 1974 of the Mine Safety Advising Committee. This case study relies heavily on the AECB's brief.

1. Federal/Provincial Arrangements

Shortly after the passage of the Atomic Energy Control Act in 1946, the Province of Saskatchewan pointed out that because Saskatchewan had detailed regulations for mining operations, confusion would result if the AECB adopted special rules for prospecting, staking, development and mining of uranium deposits. The AECB agreed that provincial rules regarding prospecting and staking should apply, but an AECB licence would be required during the development and mining stages.

In the early fifties, mining promoters wished to develop some known uranium deposits in Ontario. At this time, AECB's concerns were the security of the uranium and information regarding reserves, production and disposition. After discussion between AECB and Ontario Department of Mines' officials, it was understood that provincial authorities would take responsibility for the safety of the mines and the health of its workers. It was also agreed that the AECB would impose a condition in its exploration and mining licenses requiring compliance with provincial mine safety laws. The condition adopted and used to this day in all AECB uranium mining licences is as follows:

> That, subject to the Atomic Energy Control Regulations, any applicable provincial statutes and regulations, or the regulations affecting mining in the Northwest Territories and the Yukon, as the case may be, in so far as they deal

with mine safety and cognate matters, are to be observed and complied with in relation to the said property and to all operations undertaken in connection therewith.

During the sixties, the provinces repeatedly requested the federal government to transfer jurisdiction over uranium mines to them. Federal policy was enunciated by the Honourable J. L. Greene, then Minister of Energy, Mines and Resources in September 1968. Except in matters related to national security and foreign policy, the federal government believed that uranium mines should be subject to the same provincial rules as other mines. The *Atomic Energy Control Act*, while establishing federal government jurisdiction in matters relating to national security and foreign policy, should in no way hinder or limit provisions that ensure the application of the rules applicable to other mines under provincial jurisdiction. AECB mining permits were, and are, conditional on the licensee's obtaining the necessary property rights from the province concerned and, subject to the Atomic Energy Control Regulations, on compliance with all applicable provincial and territorial regulations. The AECB would appoint provincial officials wherever possible, as inspectors under the health and safety sections of its regulations. These policies, still in operation, presuppose the existence of adequate provincial regulatory provisions and systems for maintaining them.

2. Incorporation of Radiological Protection Provisions into the Atomic Energy Control Regulations

Since no province adopted radiological safety regulations, the AECB amended the Atomic Energy Control Regulations in 1960 to include provisions for radiological protection. These amendments were based on the advice of the Dominion Council of Health, took into account the recommendations of the International Commission on Radiological Protection (ICRP) and received the approval of the provinces, traditionally the locus of responsibility for such health and safety matters.

The amended regulations laid down requirements for protective procedures, instruments and equipment as well as maximum permissible doses of ionizing radiation. Federal, and some provincial health departments, nominated officers to serve as inspectors of the use of radioactive material other than in mines. The Ontario Department of Labour nominated some of its Factory Inspectors to supervise the use of radioactive materials in Ontario industrial concerns. The Ontario Department of Mines in 1961 nominated some of its Mines Inspectors to supervise radiation safety aspects of uranium mining operations as well as the conventional safety aspects of these operations. All of these officers were also appointed as inspectors by the AECB under its regulations.

3. Health and Safety Management of the Mines

When large scale uranium mining started in Canada in the fifties, both the authorities and the uranium companies were aware of the potential hazards of radon daughters. Most companies provided considerable forced ventilation for their mines. A radon daughter concentration of "One Working Level" (1.0 WL) was generally accepted as the "target" for use in Canadian uranium mines although most mines were operating at concentrations that were well above that level. In Ontario, the uranium mining companies were required by the provincial Department of Mines to submit periodic reports on their measurements of air contamination in different parts of the mine.

Although the AECB continued to depend on the provinces to oversee the health and safety of uranium miners, the radon daughter hazard remained of special concern. The agency maintained close contact with radiological protection experts in the Ontario Department of Health and at Atomic Energy of Canada Limited's Chalk River Nuclear Laboratories who were concerned with the radon daughter problem.

In 1959, the International Commission on Radiological Protection (ICRP) published a recommendation for the maximum permissible concentration of radon in air for occupational exposure that corresponded to an equilibrium concentration of radon daughters of 0.3 WL.

Ontario's Departments of Mines and Health called a meeting in 1960 to react to this recommendation and to assess the difficulties Ontario uranium mines were having in reaching the generally accepted target of 1.0 WL. Experts from AECL's Chalk River Nuclear Laboratories and the U.S. Public Health Service were invited to the meeting to express their views. But AECB was not consulted. From the meeting came the consensus that the ICRP recommendation of the equivalent of 0.3 WL should be adopted as a target to be attained within the next five years.

By 1964, AECB was concerned about the continuing high levels of radon concentrations that existed in the Denison and Stanrock mines near Elliot Lake. While formal reports on radiation levels had not been received by AECB, informally received information prompted the agency's President to visit these two mines to emphasize AECB's concern.

In 1967, the U.S. Public Health Service published the results of a detailed survey of hazards in U.S. uranium mines. It showed that the frequency of death from lung cancer among former uranium miners was much greater than the frequency among the population at large and varied with the radon daughter concentration to which the miners had been

exposed. Acting on the advice of the Federal Radiation Council, the U.S. government set 1.0 WL as the standard to be enforced by all federal agencies having authority in this field.

The U.S. survey sparked a review of the situation in Ontario mines. The Ontario Department of Mines hosted a meeting in mid-1967 that was attended by officers of the AECB, Ontario Department of Health and experts from the Department of National Health and Welfare and AECL. At this meeting, an AECL expert expressed concern over concentrations prevailing in the Canadian mines, reemphasized a belief that the 1960 decision to work towards the ICRP recommendation of the equivalent of 0.3 WL was correct, and recommended that as an intermediate step the regulatory authorities should insist on all mines meeting a 1.0 WL requirement. During a post-meeting visit to the three operating Elliot Lake mines, company plans were outlined for reducing concentrations. It was believed that further improvement would be possible through these efforts.

Following this meeting in 1967, AECB's President informed Ontario's Deputy Minister of Mines by letter that AECB considered the radon daughter problem to be serious and urged that the mines be required to improve the situation.

At the request of the companies, AECB's President recommended to the federal Department of Energy, Mines & Resources that a radiation instrument calibration facility be situated at the Department's mining research laboratory at Elliot Lake. This facility was established in 1968.

Late in 1967, the Chief Engineer of Mines of the Ontario Department of Mines issued a Mine Order requiring occupational exposure to radon daughters in Ontario mines be controlled to 12 Working Level Months (WLM) per year. In 1972, the control level was reduced to 8 WLM for 1973 and 6 WLM for 1974, and in 1974 to 4 WLM for 1975.

An AECB officer and officers of the Ontario Departments of Mines and Health officials met representatives of Denison Mines in 1969 to review progress in controlling the radon daughter hazard. At that time 90-95 per cent of mine working areas were at concentrations below 1.0 WL. Over the year ending, July, 1969, 9 out of 417 underground workers had received over 12 WLM exposure. The majority had received less than 6 WLM exposure. An officer of the AECB visited Rio Algom (Quirke) and Denison Mines again in 1971 and noted progress in reducing radon daughter levels.

4. AECB Mine Safety Advisory Committee

With the issuance in June, 1974, of the revised Atomic Energy Control Regulations, the AECB reviewed the following November its procedure for

the licensing of uranium mines. The Mine Safety Advisory Committee was established to consider related health and safety aspects, and make recommendations regarding conditions for licensing purposes and the adoption of appropriate health and safety standards.

The revised Regulations of 1974 require applicants for mining licences to submit pre-licensing safety reports describing:

- the procedures and equipment to be used to mine and mill the ore and to manage the waste products that are generated in these operations; and
- the measures to be taken under routine and abnormal operating conditions to protect the health and safety of the workers, and members of the public who may be affected by the proposed operations.

This information is considered by the Mine Safety Advisory Committee which then specifies the conditions required for licensing purposes.

When mining operations have commenced, licensees are required to submit periodic operating reports that include:

- summaries of radiation and dust counts in the mine and mill and employee exposures to these contaminants;
- a record of the amounts of contaminant released to the environment;
- a description of any unusual occurrences that may have affected the health and safety of the workers or members of the public; and
- a description of any changes in procedures or equipment that may affect the safety of the operations.

This information is reviewed by ABCB staff and, where appropriate, the Mine Safety Advisory Committee.

The information concerning safety is in addition to ore reserves, uranium and thorium production information that the Board currently requires of a licensee as a condition of the mining licence.

5. The Regulation of Uranium Mines - The AECB's Current Program

As the agency has stated, the AECB's regulatory involvement, both in degree and nature, was developed in response to government policy directions:

> The dominant policy direction was to make administrative arrangements whereby the provincial agencies were asked to be operationally responsible for health and safety under their regulations and the federal government, through AECB, asserted its control in licensing for purposes of security control over the disposition of ores and concentrates. During the past 20 years or more, there has been continuous pressure from the provinces to place all aspects of

the control of uranium mines completely under provincial jurisdiction with no federal involvement. The annual Mines Ministers Conferences have repeatedly urged the federal government to vacate the uranium mining field but the senior level of government refused and maintained a position of cooperative control. (AECB Brief to Ontario Royal Commission on Health and Safety of Mine Workers).

Current ABCB policy seeks a more direct involvement by the AECB in ensuring that fully effective measures are implemented to protect the health of miners. The agency acknowledges more candidly that its advisory interventions have had limited impact because of the overall division of responsibility under former policy guidelines.

6. Socio-Economic Fluctuations in the Uranium Industry

There were also socio-economic dimensions in the regulatory environment in which AECB and the provincial authorities operated during this period. The uranium industry was characterized by widely fluctuating periods of economic activity. By the middle fifties, almost a dozen mines were rushed into production, primarily to meet American contracts. The regulatory environment was characterized by pressures and the short-cuts they induced. Then the uranium industry almost collapsed when markets declined rapidly in the late fifties and early sixties. By 1961 all but three mines had closed.

A second and partly related characteristic of the regulatory and industrial environment was the significant number of foreign and migrant workers who worked in the uranium mines. As a result, the perceived impact on Canadian labour and labour unions was temporary and subject to wide fluctuations in interest. Labour unions in the uranium mining industry have always expressed great concern about work conditions but they have not uniformally and persistently pressed the issue given the periods of instability in the uranium industry.

In recent years, the unions have been persistent critics of the state of occupational health and safety, a criticism that helped to create the Ontario Royal Commission on the Health and Safety of Workers in Mines in Ontario.

(ii) *Issues Regarding the Regulatory Process*

This case study illustrates in a brief way several issues about the regulatory processes pursued by AECB.

a) While higher standards of tolerance levels have been established in regulatory form over the years, there are still major compliance problems arising from the technical difficulties of testing how much radiation exposure workers are receiving. Compliance depends to some extent on adequate base

line data and cumulative monitoring of exposure over time. The AECB and provincial authorities in 1967 had to react to an American study which showed strong correlation between cancer and prolonged periods of exposure in uranium mines. Exposure has continued since 1967, without a great decrease in dangerous concentration. The compliance programs and research and development capacities of the AECB and provincial authorities are quite obviously inadequate. Only in the last year or two have steps been taken to improve the scientific and compliance bases upon which the AECB regulates uranium mining. AECB now seems more prepared to assert federal jurisdiction in the regulation-making and compliance processes.

b) In relation to the actual processes of making regulations, the AECB again used the committee approach in this case. The composition of AECB's Advising Committee on Mine Safety does not directly include labour representation, although the committee has established relationships with labour unions to which it will send draft recommendations for comments. The AECB decided not to invite direct labour representation on the committee. Whether labour would accept direct representation or not, it should perhaps have been invited to have a representative on the Committee. AECB's committee tends to reflect two constituencies: experts in the area under discussion, and representatives of federal, provincial and local government departments and agencies. Moreover, public meetings of the committee or the AECB should perhaps be held in public to open the regulation-making process to the scrutiny of all those interested in or affected by AECB decisions.